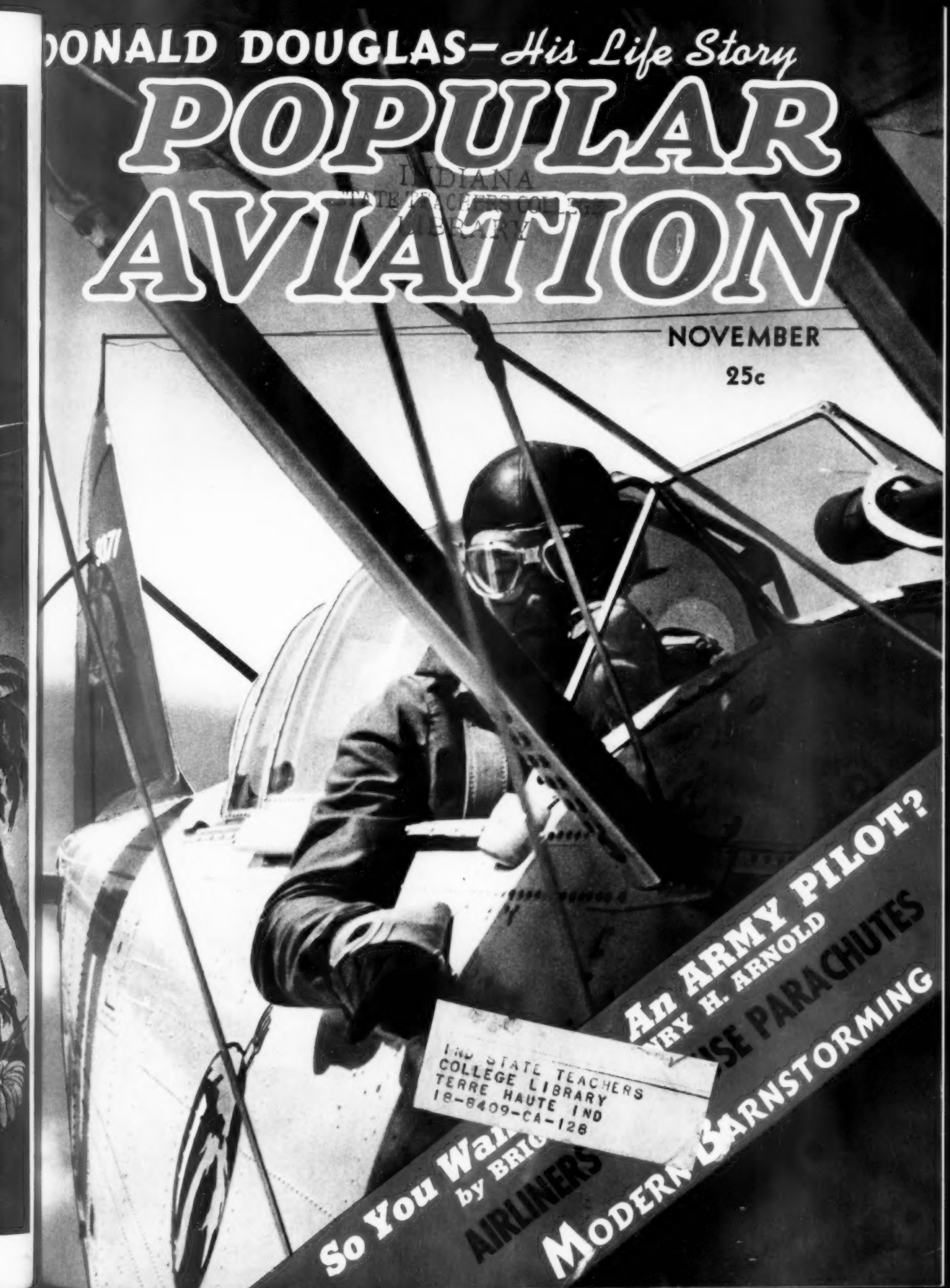
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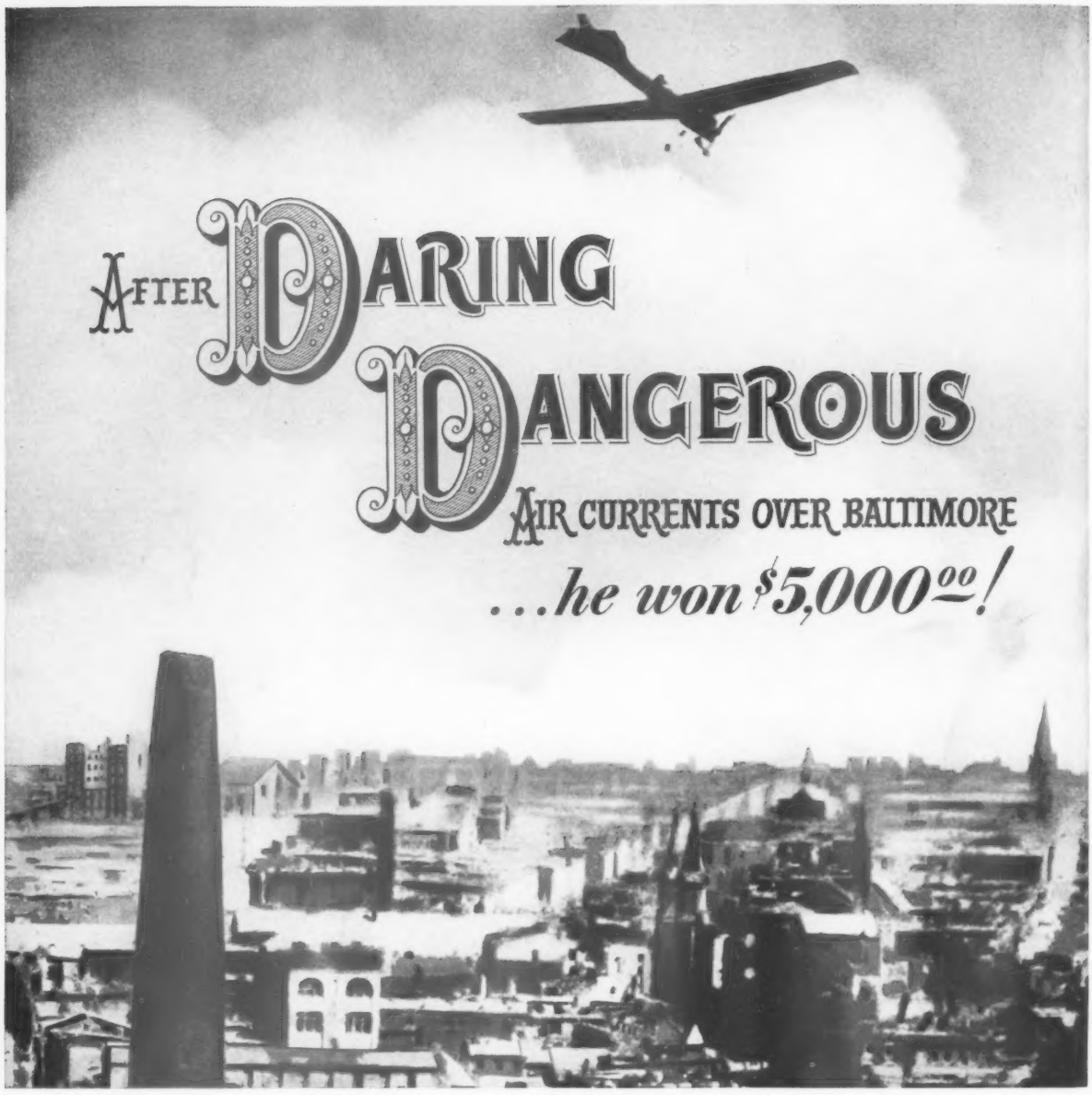

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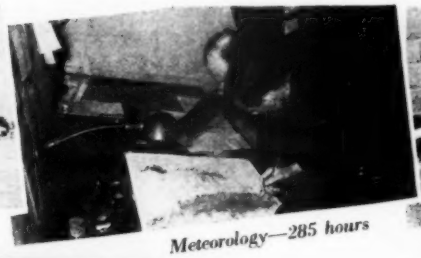

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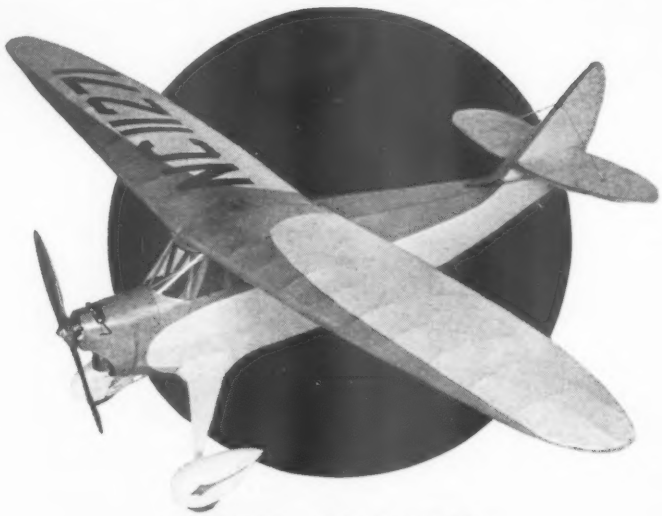

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POPULAR AVIATION, Vol. XXIII, No. 5, November, 1938. Published monthly by Ziff-Davis Publishing Company, at 608 S. Dearborn St., Chicago, Ill., U. S. A. Subscription $2.50 per year, single copies 25 cents; foreign postage $1.00 per year extra, except Canada. Entered as second class matter, January 24, 1933, at the Post Office, Chicago, Illinois, under the act of March 3, 1879.

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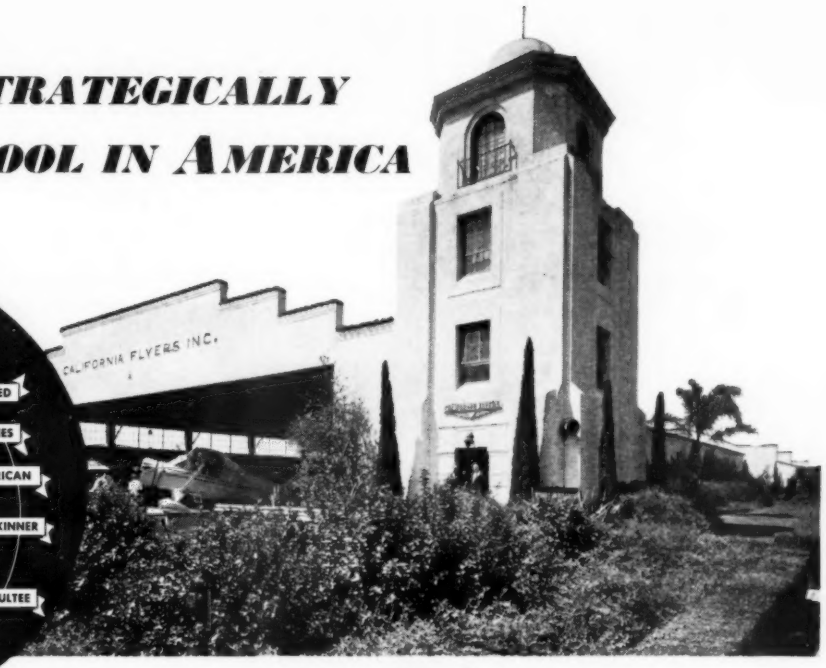

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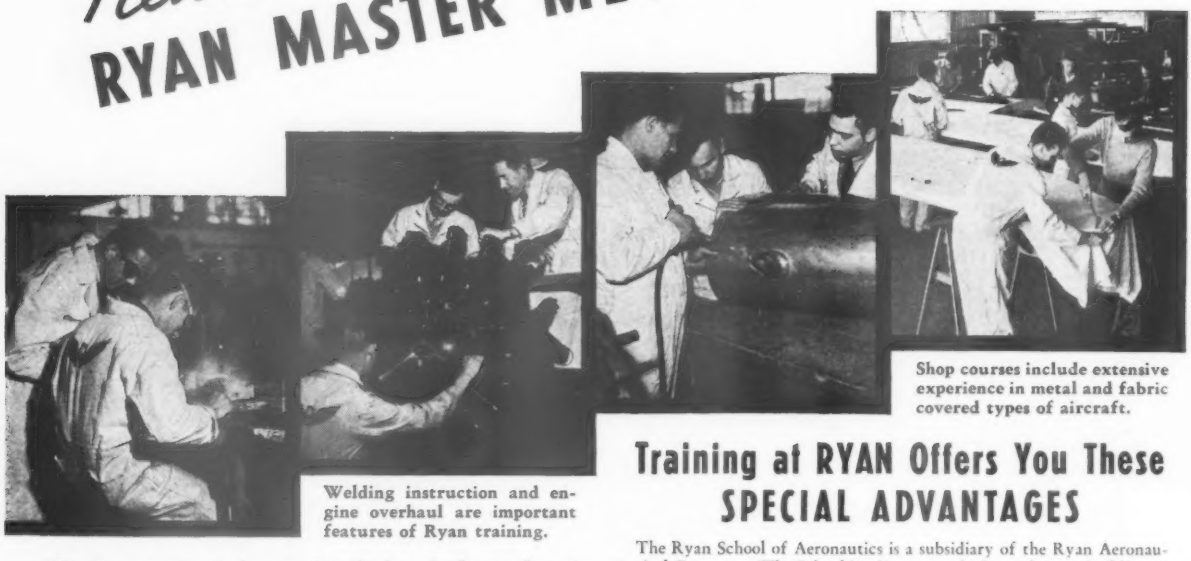

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ONE of the most important books issued for the mechanical industry at large is the U. S. Patent Office Gazette in which abstracts of the various patents issued during the week are published. It is not only valuable from a mechanical standpoint, but it also is actually a cross-section taken through conditions obtaining in many industries.

But, very strange to say, the Patent Office Gazettes, issued during the past few months show relatively few aeronautic patents, the decrease in the branch being particularly noticeable. Wonder what is holding up the inventors in airplanes and engines? Has everything possible been invented or is it the recession that gives the bulk of the inventions over to garments, household appliances and farming implements?

* * *

I GIVE mention of the National Air Races. Only one was killed and two seriously injured at this meet. All in the interests of aviation science—perhaps.

* * *

HAVE you read C. G. Grey's latest movie review in *The Aeroplane?* If you haven't read this eulogy, you should make it a point to do so. Learn why Americans wear bobbed mustaches—he thinks that he has solved the problem for us.

* * *

OUT of the doldrums of the National Air Races comes good news of Col. Roscoe Turner, the only good news that has reached us from this source. Three cheers for the Colonel who sure deserves a break in the chain of hard luck that has been following him for months. To win the Thompson Trophy and then to add further laurels by establishing a new world's record is a real achievement. But, while enjoying Turner's victory, we are faced with the sad news of another old-timer, the death of Frank Hawks, the veteran of many racing events in years gone past. The passing of Frank Hawks leaves a vacancy in aviation that can never be filled, for he was more than a pilot who contributed much to modern aviation progress.

(*Continued on page 74*)

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Cover Photograph: U. S. Navy pilot by Henry F. Kroeger, Jr.

(Insignia on plane's fuselage designed by POPULAR AVIATION for Naval Reserve Squadron on VS-9R.)

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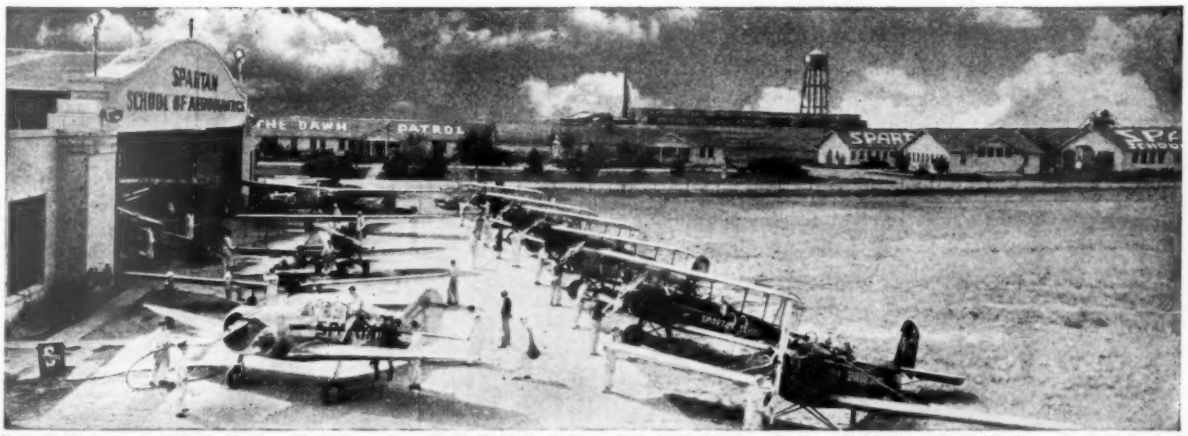

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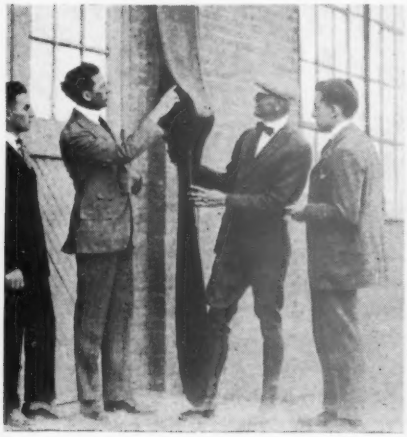
1 Donald Douglas at the age of four.

2 Midshipman Douglas in Norway on an Annapolis cruise.

3 In 1915, only a short time after his graduation from M.I.T., Douglas designed his first ship, the Martin "R" (above). He then was in his early twenties.



4 Lawrence Bell, Martin, Springer and Douglas (l. to r.) in 1917.

5 Eric Springer, noted pilot, and Douglas (right) in the cockpit of a Martin bomber. The year: 1917.

6 David Davis (right), rich sportsman, played an important part in Douglas' early days.

7 Resigning from the Martin company, Douglas, backed by Davis, opened this office in a Los Angeles barber shop. Year: 1920.

8 With one order—from Davis—Douglas set to work to produce his cumbersome Cloudster in this planing mill with 12 men to help him.

9 Douglas (left) can be seen below working on the Cloudster in the planing mill. Opposite him is his present factory boss.

10 Building the Cloudster (below). Some of these men still are with Douglas. He is in the ship's cockpit. Bill Henry is near far wall.

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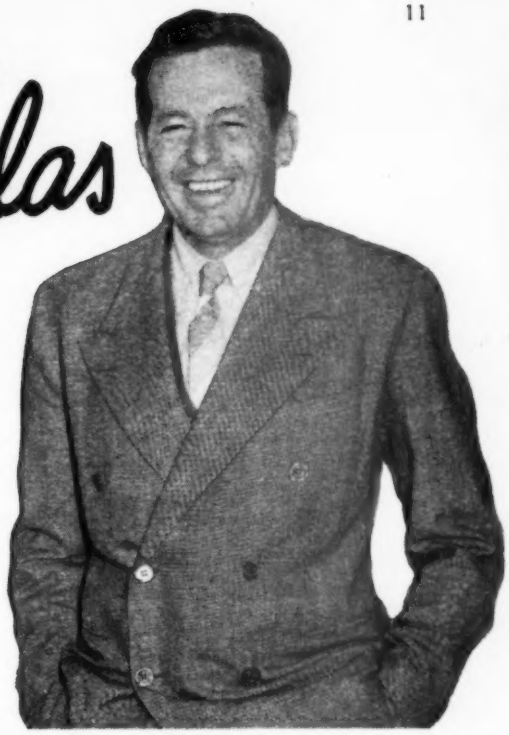
Donald Douglas

HIS LIFE STORY

by FRANK CUNNINGHAM

This is the story of a young fellow who built model airplanes, dreamed fantastic dreams and quit Annapolis when his future seemed assured.



Donald Douglas today.

TAKE a shiny bank jammed with pennies, dimes and half dollars. Break open this bank and mix the glittering coins with Annapolis students dreaming of ships with wings. Add a rich Hollywood sportsman, a newspaper reporter, and a piece of paper on which are ten signatures. Fuse this with an abandoned motion picture studio and an Around-the-World flight. Gloss over this the image of a youngster who created a vision of commercial air conquest at a time when most flyers were barnstorming in aerial coffins. Then cast an engulfing shadow that sweeps out of Time: a shadow of the biggest airplane factory in the world.

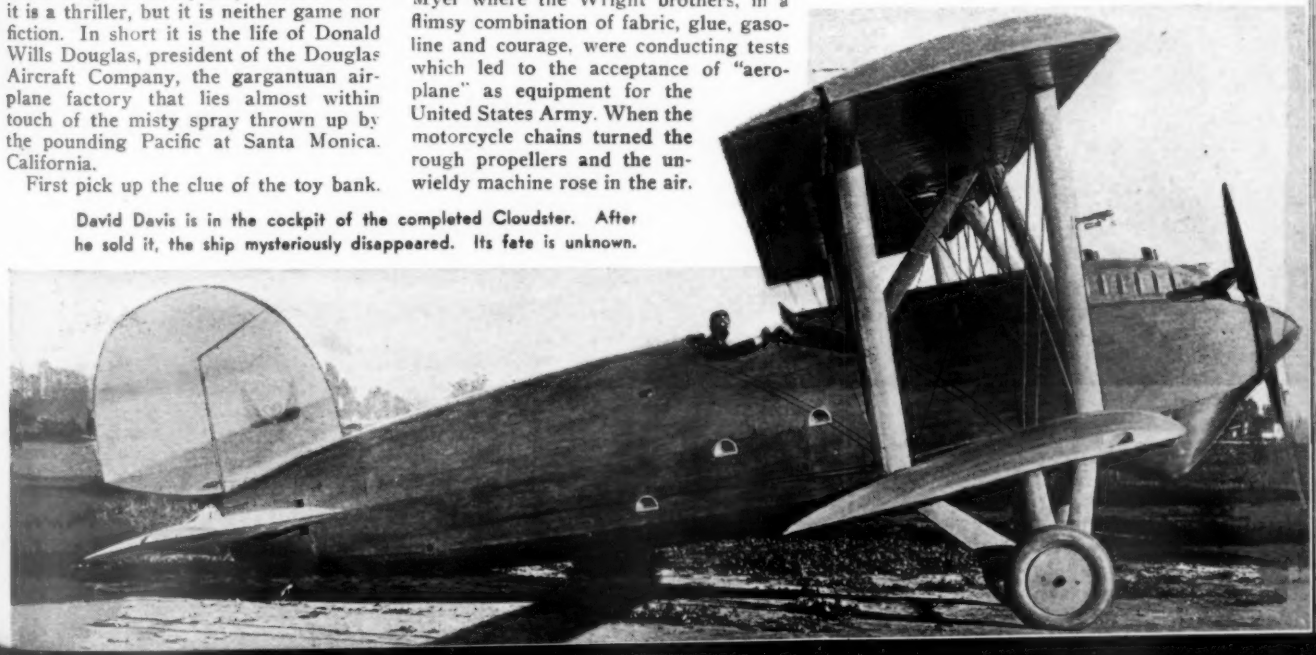
All the above may sound as if it were a game of intricate design, or the plot of some complicated mystery thriller. Well, it is a thriller, but it is neither game nor fiction. In short it is the life of Donald Wills Douglas, president of the Douglas Aircraft Company, the gargantuan airplane factory that lies almost within touch of the misty spray thrown up by the pounding Pacific at Santa Monica, California.

First pick up the clue of the toy bank. This rested serenely in a corner of a dresser drawer in a midshipman's room at Annapolis. The owner's name was Donald Douglas, son of a New York banker of Scottish descent.

One day in the spring of 1909 (he was born in New York City in 1892) Midshipman Douglas forgot his 18 or so years of acquired knowledge, robbed his own bank, left the Academy for a short time by means of the quarters and halves he had taken unto himself.

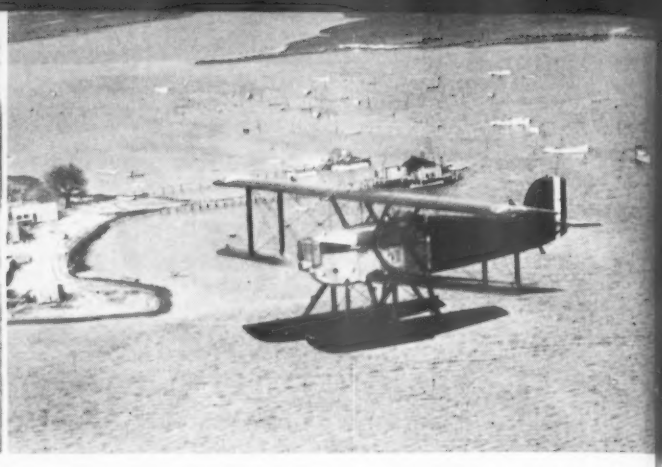
Perhaps if it weren't for that bank episode the Navy today would have another officer and the aviation industry would be minus one of its outstanding geniuses. For it was to Fort Myer, Virginia, that the middie went. To Fort Myer where the Wright brothers, in a flimsy combination of fabric, glue, gasoline and courage, were conducting tests which led to the acceptance of "aeroplane" as equipment for the United States Army. When the motorcycle chains turned the rough propellers and the unwieldy machine rose in the air, the young visitor from the Naval Academy conjured fancies whose ceiling was far above that of the airplane that cut the Old Dominion sunshine.

Young Douglas had never welcomed a career on a battleship although his father's ambition was for his son to become a Naval officer. So it was that, after preparatory education in the public schools of New York, Donald went to Annapolis. With him went yearning and enthusiasm—not for the sea, though. The efforts of Wright, Langley, Chanute, of European inventors had given young Douglas visions that were not of the sea or the land. He dreamed of cargoes shimmering through the skies. He visualized the need and the growth



David Davis is in the cockpit of the completed Cloudster. After he sold it, the ship mysteriously disappeared. Its fate is unknown.

12 In this abandoned old motion picture studio, where Douglas moved in 1922, were built the famed Army World Cruisers.



13 Douglas still uses the slogan "First Around the World." This is one of the Army ships that made the historic flight in 1924.

of commercial aviation as prophetically as did Jules Verne foresee the wonders of the future.

Prophets, alas, are usually doomed to disappointments. Their plans, hopes, all vanish as their age-dimmed eyes close for the last time. But Douglas was young. Pioneers of aviation's cradle were soon to drop by the way—*but Douglas was young*

Too close he was to the "infant" stage for the braided powers of the Navy Department who rejected, shortly after Douglas' return from Fort Myer, a plan for the incorporation of aviation in the Navy; a plan drawn up in Academy rooms by Donald and a band of would-be birdmen and submitted by a legislator friendly to the middies.

Youthful Donald Douglas saw beyond the musty chambers of Congress, beyond the encircling tentacles of red taped procedure in the Navy Department, even beyond the tradition-coated buildings of Annapolis. He resigned in 1912.

The story is that he hit an admiral with a toy airplane which sailed too recklessly in the buoyant wind and the dignity of the officer would allow him to see nothing constructive in a future guardian of the seas dabbling with playthings. I'm not saying that Washington didn't cut down the cherry tree and I'm not saying that Donald Douglas didn't, with "admirable intent" sail a Lilliputian plane through the swirling Maryland air.

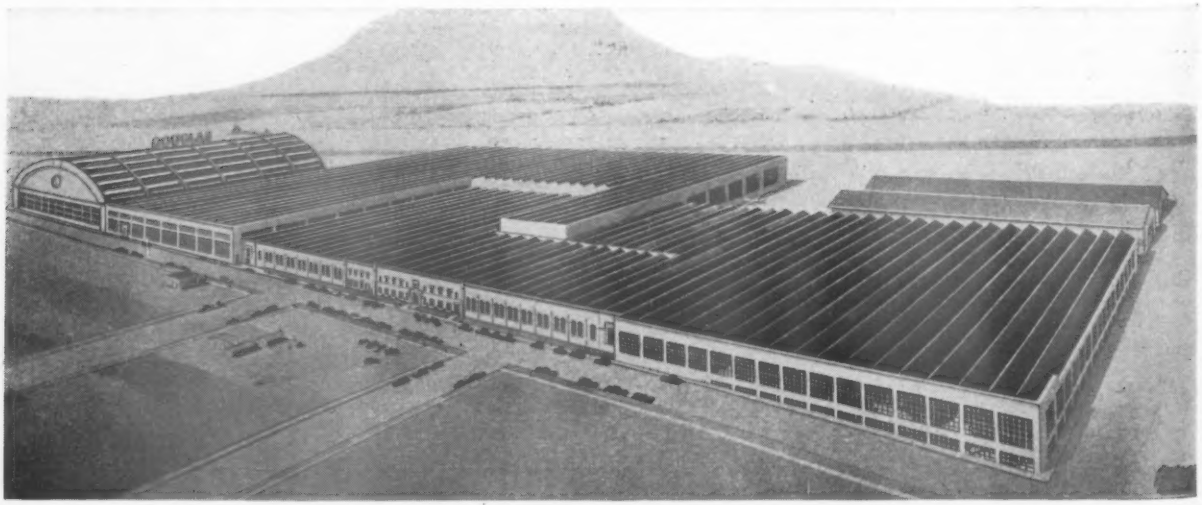
From the Academy Douglas went to the Massachusetts Institute of Technology for his senior year. There he plunged into technical studies that were to polish his college education as an aeronautical engineer. Soon he was putting his text-book theories into more theories with Commander J. C. Hunsaker, who built the first "wind tunnel," one of the most important testing devices in the development of flying. Following this work Donald was with the Connecticut Aircraft factory; then worked on the D-1, the first dirigible built for the United States Navy.

Meanwhile brilliant Glenn L. Martin had established an airplane factory in a dismal old building in Los Angeles. However, Martin's factory prospered with orders from the United States and foreign governments. When Martin needed a young aide he looked eastward—eastward to Donald Douglas. In 1916 Douglas joined the Martin company as chief engineer, but after a year returned east to be the chief designer for the aviation section of the Signal Corps. However, he shortly resumed his work with Martin, this time in Cleveland. The 25-year-old veteran of aviation soon rose rapidly in the organization. He helped design the famous Martin bombers and in a score or so months was vice-president and chief engineer of the Glenn L. Martin company.

Most lads of 28 are happy to be within two or three offices of a vice-president's private chambers, but Douglas resigned from the vice-presidency and decided to strike out for himself. This was in 1920 when the aviation industry was lower than the ill-fated *Lusitania*. The Armistice had seen the warring armies—and also the airplane market—fold up. Former ace flyers were organizing "circuses" so they could eat, even then not three meals a day. The future of possible commercial aviation was thought to be as uncertain as, say, Shirley Temple's if she suddenly became six feet tall and talked with a Zulu accent.

Douglas admits today that he must have been a fool to have attempted what he did and that if he had known as much about business in 1920 as he does now, the vice-president of the Martin company would have been delighted with his position and stayed on.

17 Constantly forging ahead, Donald Douglas moved his factory in 1929 to its present location at Clover Field, Santa Monica. The original factory has been enlarged several times until, as shown here, it occupies 1,000,000 square feet and employs 8,000 men.



14 Douglas (right) and Springer watch Navy officer check barograph after record flight in 1921.

15 Douglas poses with Lieut. Eric Nelson, one of the Army round-the-world pilots.

16 The Douglases pose aboard ship before Hawaiian trip.

Southern California, he thought, was the ideal place to build his commercial ships. Douglas returned to Los Angeles. The City of the Angels was filled with his plans, his enthusiasm, his potential ability to create a place for commercial flying. Most everyone liked the young man who carried blueprints under his arm and tremendous schemes in his head. And, at the same time, everyone was united in keeping a tight hold on their money in the bank. Eventually Douglas' shoes began to wear thin and the rough pavements began to make their presence known.

Donald Douglas was faced with the fact that his acquaintances who had any money, from engineers to wealthy bankers, thought his ideas fantastic. They advised him in no uncertain terms to get out of the airplane business, if indeed it were a "business."

Shelving because of economic necessity his plans for commercial ships, Douglas managed to get an order from David R. Davis, a rich Hollywood sportsman, for a plane in which Davis could attempt a coast to coast flight. Thus was born the Davis-Douglas Company and their first office was "desk space" in a barber shop. Here while the barbers clipped hair, gave singes and talked about the Giants and the White Sox, Douglas designed his first Douglas plane, the *Cloudster*. The plane itself was constructed in a planing mill in Los Angeles.

This ship, a single-motored biplane with a wide cruising range, took off cross-country early in 1921. It was the first effectively streamlined plane, boasted the first gasoline dump valve in aviation history, and carried many new instruments. But motor trouble developed and Pilot Eric Springer (who still is with the Douglas company) and Davis were forced down near El Paso, Texas. They had to abandon their quest. Although the plane was soon repaired, a duo of Army aces, Lieutenants Oakley Kelly and John Macready did jump from New York to San Diego. Sportsman Davis, deprived of being the first across the continent, put the *Cloudster* up for sale.

Meanwhile Douglas had married Miss Charlotte Ogg and his financial status had to be stabilized. Despite the failure of the *Cloudster* to get across the country, Davis agreed to help Douglas, financed his way to Washington to sell the Navy *Cloudster* ships. The former Annapolis cadet came out of the Navy Department building with an order for $120,000 worth of *Cloudsters* which the Navy was going to use as Torpedo carriers.

Douglas must have found affairs agonizing when the $120,000 contract meant nothing to the flint-hearted rulers of the money marts in Los Angeles. Despite days made weary with pleadings for a loan, Douglas' bankroll stayed as flat as a breakfast pancake. The princes of the payrolls didn't care if Douglas' plans went up in the air as long as their money didn't do the same.

Now enters the reporter mentioned in the first paragraph His name is Bill Henry, he's still with the Los Angeles *Times* and he's one of the best known sports editors in the country At the time of Douglas' trouble, though, Bill was just a reporter. In a barber shop

(*Continued on page* 84)

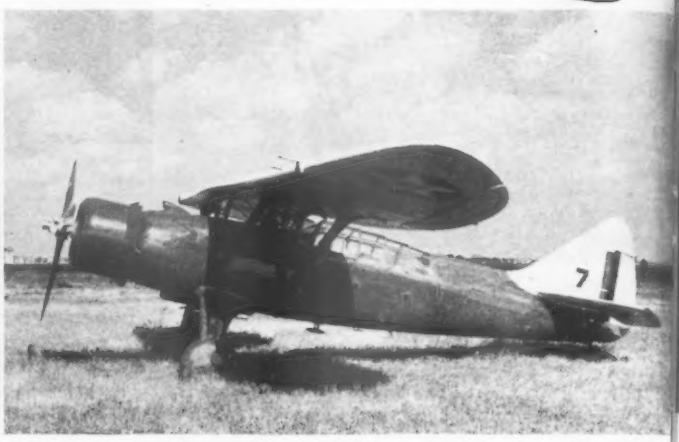
18 William E. Douglas, Donald's father, proudly flies in his son's airplanes.

19 The famed manufacturer received the Collier Award for 1936 from President Roosevelt for the outstanding advance in aviation for that year (the far-famed DC-2).

THESE AIRCRAFT HELPED MAKE Donald W. Douglas

ARMY

Both the Army and National Guard will have great and lasting respect for the rugged Douglas observation ships like those in this picture. Many now are being condemned because of age.



To replace the reliable old biplane now being done away with (see left) Douglas engineers evolved this trim parasol-winged monoplane, many of which are currently in use by the Army and National Guard.

NAVY

Douglas has played an equally important role in Naval aeronautics. These old twin-engined flying boats were photographed from a sister-plane during maneuvers on the California coast.

Proof, however, that even the best manufacturers must take chances is this experimental torpedo-bomber entered by Douglas in Naval competition for contracts. Naval procurement officers turned it down.

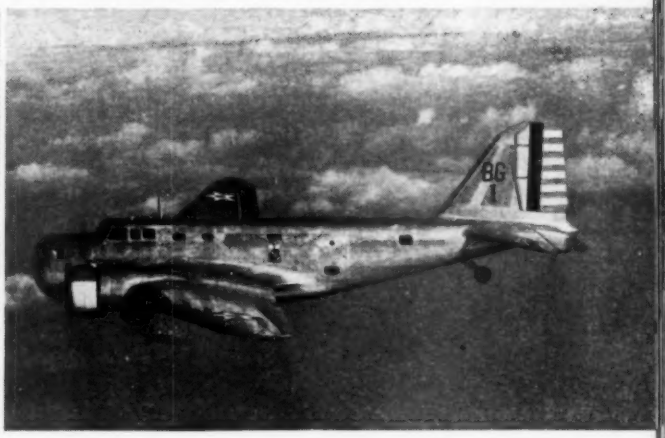
COMMERCIAL

Not many persons, even in the aviation industry, realize that this flying boat was a Douglas product. Known as the DF, a few were manufactured, some of which were exported to Russia.

This is the DC-2, perhaps the most famous modern-day transport in the world. It was for this design that Donald Douglas received the Collier Award for the greatest contribution to aviation in 1936.

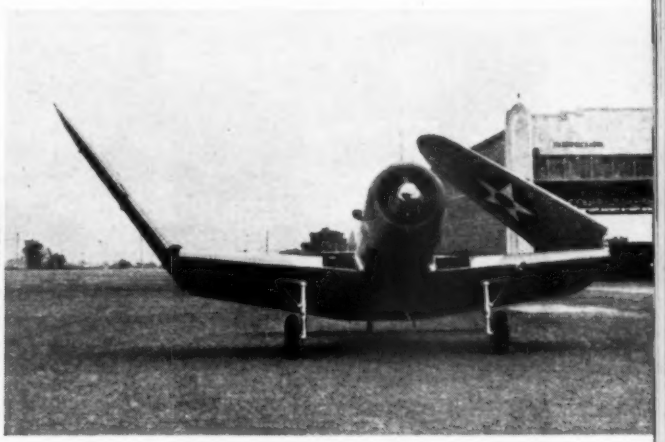
THE MOST FAMOUS NAME IN WORLD AERONAUTICS

Though strikingly similar to the Dolphin directly below, the Army amphibian above is nonetheless an entirely different airplane. A bit larger than the Dolphin, the OA-5 is for rescue and liaison work.



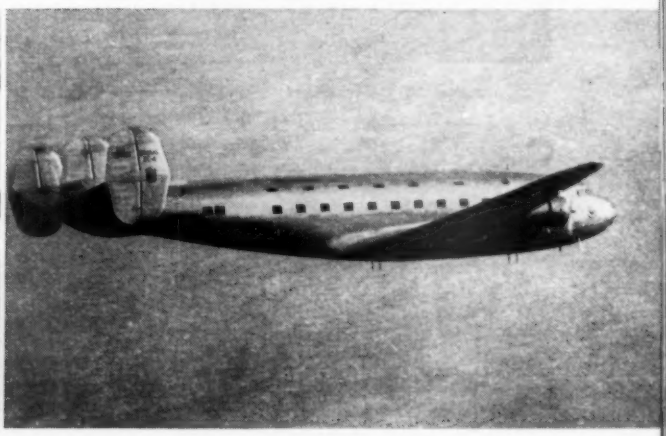
Currently popular in the Air Corps is the B-18 twin-engined bomber. Now being delivered in quantity, this ship is a military adaptation of the extensively used DC-3 airliner.

So popular and reliable has the Douglas Dolphin been that the Army, Navy, Coast Guard, a few commercial airlines and even private owners have favored the model for several years. Many still are in use.



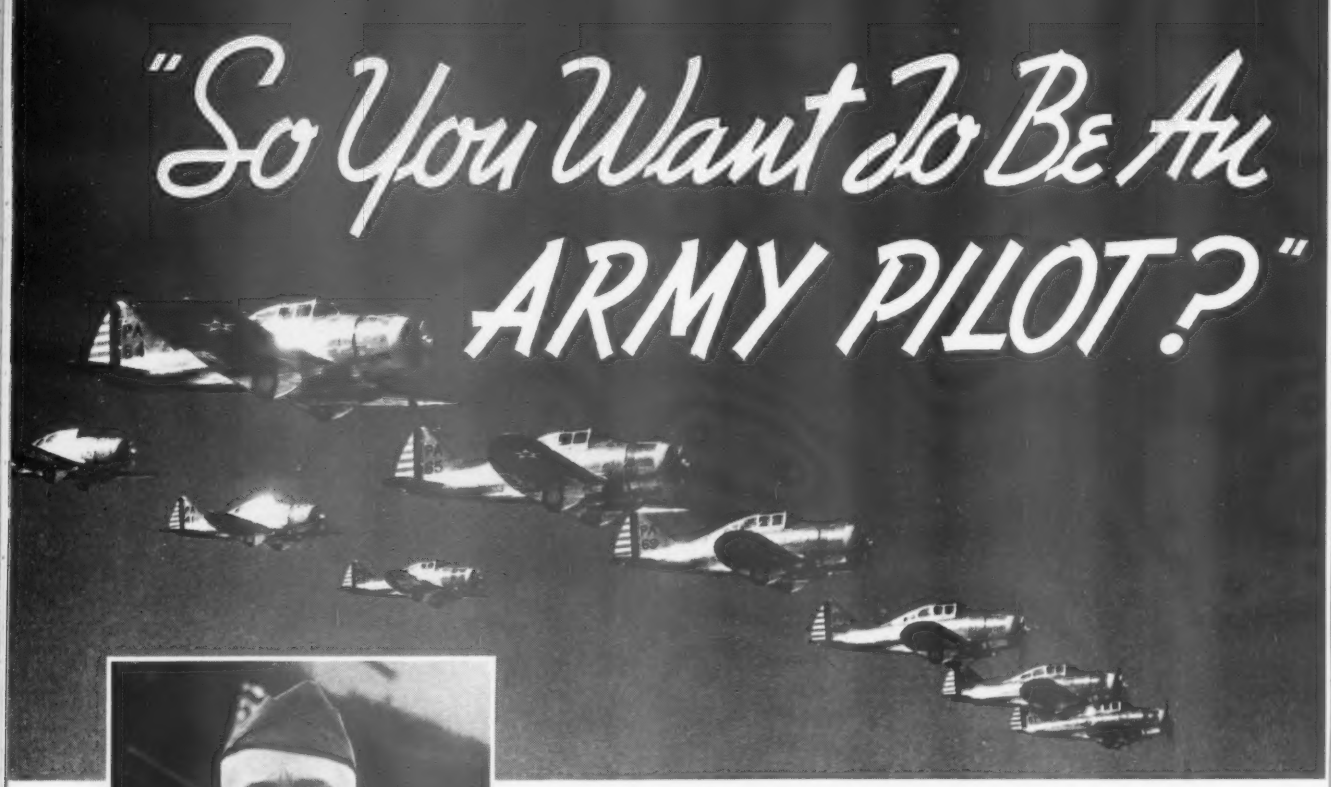
Latest Douglas Navy design is the striking TBD-1, now in use aboard aircraft carriers. Its queer folding wings are operated by the pilot and are space-savers aboard carriers.

If you fly on any of the world's major airlines today the chances are good that you're liable to find yourself aboard a DC-3. A development of the DC-2, the DC-3 is supplied as a dayplane or sleeper.



The four-engined DC-4 will be as important to Donald Douglas' future as was the DC-2. Now being tested exhaustively, the DC-4 has a tricycle landing gear and will carry 42 passengers.

"So You Want To Be An ARMY PILOT?"



The majority of the pilots in this pursuit squadron are cadets from Kelly Field.

The author, Brig.-Gen. H. H. Arnold.

by **BRIG.-GEN. HENRY H. ARNOLD**
Assistant Chief of the Air Corps

You fellows with military flying aspirations will find all the answers in this article.

SO you want to be an Army pilot? You can, perhaps, and here are the qualifying conditions upon which depend your ability to join more than 50,000 young Americans who have had similar ambitions since 1909 when Orville and Wilbur Wright began the training of Lieutenant Selfridge, the first Army flyer.

You must have a sound, near perfect physical set-up, controlled and directed by sane and well balanced mental and nervous system.

Preferably, you should be a college graduate, but two years of college or the equivalent, as demonstrated in a mental examination, will suffice. However, with but two years of college you must go on the waiting list below those who hold college degrees.

And now, possessing the body, the mind and the education, there is but one thing left: You must demonstrate that you possess the ability to learn to fly; you must have the application and perseverance to make the grade at the Army's Air Corps training center, a year's course at the finest flying school on earth.

Fortunately for the young man with the ambition to be an Army flyer, he is not confronted with the economic problem which handicaps many young men in their search for education and self-improvement. The Army flying cadet is paid while he learns. He is paid a salary of $75 per month and is furnished food, clothing and shelter free of cost.

Contrary to a conception which has now become quite widespread, the physical examining room is no chamber of horrors. The physical and mental requirements are high, the examination is thorough and detailed; it is true that only about one out of four who apply are found acceptable. But the normal, healthy boy who has lived a clean, outdoor or athletic life and who is between the ages of 19 and 27 has a fair chance of passing. The very first thing that any young man should do who finds his shoulders itching where the wings are trying to sprout is to go to a good doctor, preferably one who is familiar with the Air Corps physical requirements, for a preliminary examination. That is the first thing to do. There is no use to nurse this ambition to fly for years until it becomes a consuming passion and then find that your eyes, your circulatory system, or some other physical defect is completely disqualifying.

Some have felt that we have made a mistake in our educational requirements. They point to a Douglas Corrigan, or to one or more of the many other young men who have learned to fly in civil life because they did not have that educational standard and have later demonstrated to the world by remarkable flight exploits that they would have made great fighting flyers.

Here is our answer. We admit readily that a Rhodes Scholar is not more likely to become a good flyer than many a high school graduate. But there are many things an Army flyer has to do

and become proficient in besides flying. Many of them have to become engineers, navigators and technicians—photographic, electrical, mechanical and otherwise. All of them will eventually have to lead, teach and control younger flyers coming on. They will have to compete with other young officers, many of whom will be graduates of the West Point Military Academy. They will be handicapped and embarrassed and disappointed all their lives as they struggle through the Army ranks if they do not possess good basic educational foundation.

As a matter of fact, if an American boy possesses a real desire to join the Army in the clouds, he will have the energy and initiative and perserverance to get that needed education. Here is but one of many examples in proof of that, which have come to my attention during the last 30 years:

In the early days, one of our soldiers was bitten by the air bug. He had left school to follow the flag when but a boy. He had less than a high school education. His pay was but $21.00 per month. What to do? Flying lessons in those days were expensive, indeed, and the Army had no flying school for civil or soldier applicants as it has today. This ambitious young soldier finished his military duties at 5:00 p. m. daily at retreat. Immediately thereafter he set off several miles to the nearest night school and spent the evening there, walking back to his barracks about midnight. Day after day he followed this killing grind—for three years. He made up his necessary literary credits. Next, he spent all his free hours, week-ends and holidays at a civil flying school servicing and washing planes, cleaning out hangars and doing all the rough work about the flying school—for one hour of flight instruction a week!

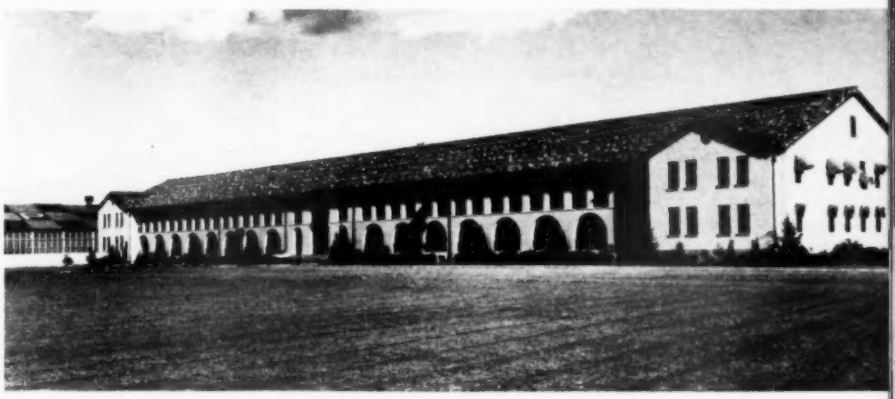
Today, that man is the oldest flyer in in point of continuous flying service in our Army Air Corps.

Once upon a foul and foggy afternoon I splashed an old DH down upon a cow pasture in a Southern state. Scarcely had I time to write it down in my flight log as an emergency landing due to weather, by the last failing light, when an interested crowd, attracted by the noise of my sputtering motor, began to arrive by flivver, horse, mule and foot.

Willing hands helped me stake the water-logged craft down for the night and cover the greasy old Liberty with canvas. Then I addressed the fringe of the overalled crowd in search for a suitable guard for the Army plane for the night, as regulations required. A six-foot youngster in his late teens stepped immediately from the crowd and offered his services.

Next morning, when I returned to my plane, the boy sat in the cockpit. He had a lap full of notes. He had out the pilot log and the engine handbook. He had made a drawing of the instrument board, noting accurately the location of everything in the cockpit. I would have turned him in promptly as a spy, except that his Southern accent and frank open

Through Randolph Field's famous gates each year goes a small group of hopeful birdmen. Some come out heartbroken, others happily en route to the advanced flying school.



The flying cadet will spend many happy and hard-working days at Randolph Field. His home will be the cadet barracks above. All Randolph Field buildings are ultra-modern.

It may look silly to the outsider, but garter inspection is a regular procedure.

A cadet in a Stearman trainer practices some homework. Note Randolph Field below ship.

A flying cadet's life is not the fearful nightmare Army regulations would make it seem. Here is Randolph Field's extremely popular swimming pool. Women swim as guests.

face belied anything other than consuming interest in my old flying machine. After helping me pull the stakes and uncover the engine, he made a bashful inquiry: "Does the Army ever train any country boys to be flyers?"

After learning that he was but a high school graduate, 18 years of age, with an aptitude for things mechanical, preferably mechanical things that flew, I gave him quickly but earnestly the best advice I knew.

"Get a college education—at any rate get at least two years of college. But before you do anything else, go over to Atlanta, take this note to this doctor there and get a preliminary physical examination. Find out whether you have any defect which will be disqualifying. That is the first thing to do—find out if you are physically qualified. Then get the requisite schooling. When you have done that, write me a letter and I'll send you application blanks.".

Slightly more than two years later I received a letter. The address was unfamiliar, the name was unknown, but the contents soon brought back memories of that forgotten forced landing. The boy sent in proof from a mountain college that he had completed two years of work. He enclosed a brief memo, two years old, showing that the doctor, who had been a flight surgeon, considered him a near perfect physical specimen. He wanted the blanks.

He got them. I took renewed interest in the boy. He had shown that he really was sincere in becoming an Army flyer. That young man today leads a fighter squadron in our Air Corps.

These two success stories are picked at random from many I know and they convince me that our requirements are not set too high; they but enable us to get better men. Those who have the energy and resourcefuness and capacity to work like that appreciate their opportunities all the more. They make our best men.

Now, what does the young flying cadet applicant find awaiting him when he arrives at Randolph Field, our primary flying school at San Antonio, Texas?

He is greeted first by representatives of the preceding class who are now on the advanced stage and are called "upper classmen," which gives them the privilege of conducting the incoming class through its shake-down, or initiation period. They help the new classmen learn the routine of barracks life, show him his room, how to draw his clothing and flying equipment; they serve as the upper form. Those who have been through military school will know what that means. There has never been, however, any taint of brutality or hazing. This shake-down cruise the upper class gives the incoming recruit has some very beneficial effects, and probably is looked back upon by the graduate as one of the interesting periods of cadet life.

The incoming cadet will find his class made up of boys of his own age from every state in the union. Texans and Californians will be a little more numerous than the rest, as more of our cadets come from those two great states than from any of the others, but most likely all will be represented. There will be about 350 clean-cut, clear-eyed youngsters, all with one common purpose—the earnest desire to learn to fly. That association, that competition between rich boys, poor boys, farm boys, city boys, only sons and those who have come up by their own efforts, is probably one of the finest features of our flying school. No boy is judged by his past, by his father's status, by his monetary rating, by his looks, or by his name; every one is judged solely by his conduct, efficiency, ability and capability in the tasks assigned at the school.

Some idea as to the number of flying cadets at Randolph Field is gained from this photograph of Stearman trainers on the line there. They are in use all day long.

There will be drill and the rigid routine of the soldier. There will be early rising, calisthenics, a morning spent in flying instruction, an afternoon devoted to ground school subjects: engines, navigation, theory of flight, radio, photography, map making, aero repair and shop work. The work day will conclude with games and sports of every variety. Facilities abound for almost every sport from polo to table tennis. In the evening there will be a period of study—then early lights out. Nothing is allowed to interfere with that main purpose—teaching the flying cadet how to fly and all that goes with it. There will be four months of this regular routine where the fledgling will be on the primary stage. Then he will move up a notch to the advanced stage of the primary school, provided he has made the grade thus far. The heart-breaking part of this game is that some will have been dropped out. There can be no equivocation, no vacillating. If the instructor is convinced that the student will not make a safe flyer, he is sent up for check flight with the stage commander, by way of verification. If that old-time flyer finds, as the instructor has, that the boy is not suited, not sufficiently adaptable for the new life upstairs, then regretfully he is sent home.

Sometimes "washouts" feel that it is a harsh system which thus dashes the hopes and ambitions of youngsters whose souls are seared with the desire to join the flying world. Sad experience has demonstrated that there can be no soft-heartedness here. The records of our fatal crashes show that those men who have been doubtful prospects, who have taken to flying instruction slowly, whose progress has been subnormal, have been the first to fall after they have joined their tactical units. In the interest of safety, we must hold our standards high and measure the student up to them rigidly.

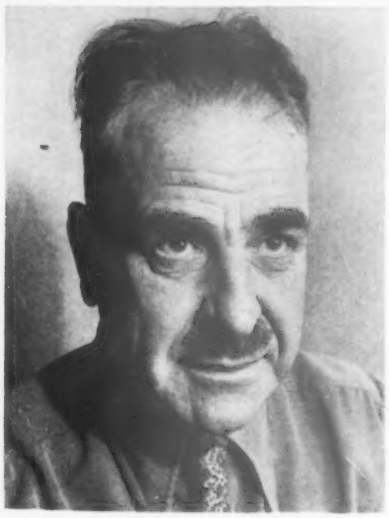
On the primary stage the cadet rode some ten hours with his instructor, then he was sent up alone. That solo landing was probably the high light of his flying career. Thereafter on the primary stage he perfects his flying technique by one to two hours of flying daily under the watchful eye of the instructor. He then is taught the rudiments of acrobatics, how to put the plane in abnormal flying positions and how to recover from them.

On the advanced stage (the last four months of his eight at the primary school) he does more flying alone. He takes up more advanced maneuvers designed to increase his skill at airplane pilotage. He makes cross-country flights, night flights, strange field landings. He spends many hours on acrobatic maneuvers. He is taught the elements of

(Continued on page 86)

FRANCE'S OCEAN-FLYER

Though already more than five years old, this giant six-engined Latecoere 521 flying boat recently spanned the north Atlantic.



This 60 ft. plane 'chute has proved its ability to lower a large airplane safely. It was designed by Jimmy Russell, an associate of the author's at Wright Field.

Lt.-Col. E. L. Hoffman
U. S. Army, Ret.
In An Interview With
HAROLD KEEN

Says "AIRPLANES

PARACHUTES for transports! Huge, full-blown silken canopies suspending giant disabled airliners in comparatively slow descent toward the earth, saving lives that otherwise would be hopelessly doomed, relieving the horror of those last few seconds before an inevitable crash, the horror that comes from being helplessly trapped in a plunging meteor of a plane!

That is what I envision for the not-too-distant future—a positive method of supplying the safety that can never otherwise be complete as long as gravity will pull distressed airplanes down, causing passengers to fall into a jumbled heap from which there is no escape.

"It's fantastic! It won't work! It isn't practical!" These are the buckets of doubt that have been used to swamp the idea, but whenever I am confronted with a scoffer two thoughts flash to my mind.

I recall poor Lieut. Frederick W. Niedemeyer, one of the few Army flyers at McCook Field (now Wright Field) in Dayton, O., who was willing to endure the "discomfort" of being harnessed to a parachute in the early experimental days right after the War.

Fred had been wearing them religiously, but one day he went up without his 'chute because it would have caused his head to stick out above the windshield of his little Fokker D-8. Fate played him a mean trick that day. While maneuvering overhead, a wing ripped off the plane and it went into an uncontrollable spin. We stood on the field, spellbound by the craft's plummeting to destruction. There would have been plenty of time for Lieutenant Niedemeyer to jump. But his parachute was in the hangar instead of strapped to him.

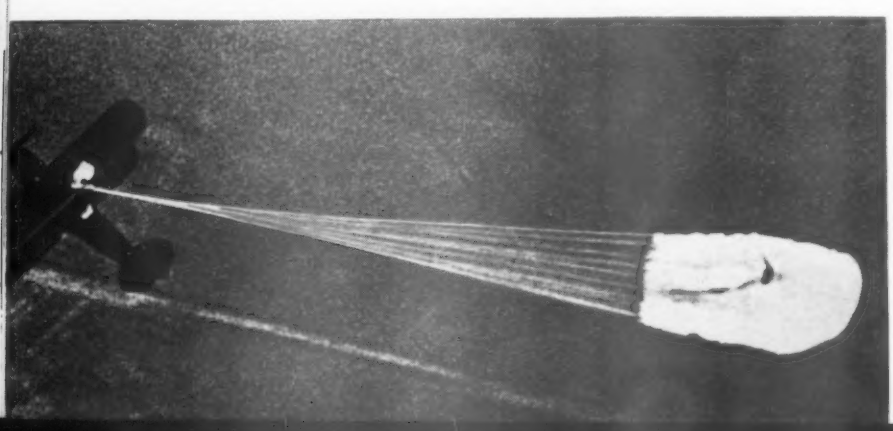
This fatality, which occurred before the eyes of the late Col. Thurman H. Bane, commandant of McCook Field, resulted in the general order that all flying personnel under his command must wear parachutes. The men who had laughed at me and my small but loyal group of assistants had been shocked into a realization that the parachute was not a fantastic and impractical plaything.

And about a year later, when the ailerons of Lieut. Harold R. Harris' Loening observation monoplane flew off and he jumped to safety to become this nation's first heavier-than-air Caterpillar, we knew that our long period of trying to put across the parachute idea had come to an end. We were vindicated. Maj. Gen. Mason M. Patrick, who was chief of the Air Corps then, made the wearing of 'chutes a requirement in all Army flying. But only after repeated disasters had the individual parachute overridden skepticism.

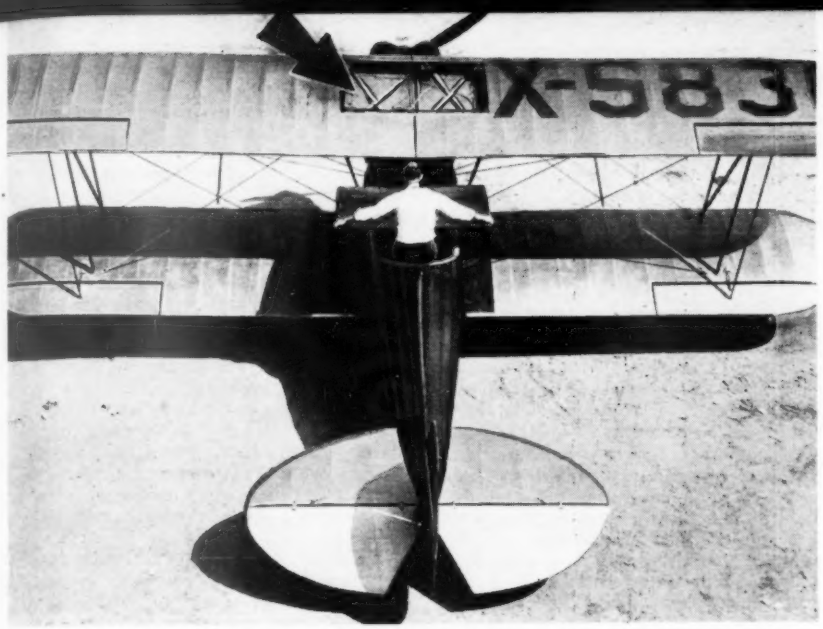
The second thought that occurs to me concerns an Army transport loaded with six passengers, a pilot and assistant flying in the vicinity of Brooks Field, Tex., several years ago. My "crazy" idea of parachutes had been universally adopted for some time, and all the men in this plane wore individual 'chutes.

Suddenly, as in the case of Lieutenant Niedemeyer, a wing pulled off at an altitude of about 4,500 feet. In the resultant nose dive, the pilot and co-pilot were thrown out and came down safely in their parachutes. But meanwhile, a scene of unutterable confusion was taking place back in the cabin.

The moment the nose dropped, the six passengers were thrown forward in the cabin, as though they had been shot from a ceiling to the floor. To reach the sole exit, a door at the rear end of the cabin, they would have had to climb nine or ten feet vertically in a plane spinning wildly. Even if the door had been in the front of the cabin, none of them could have emerged from that terrific, desperate scramble in the 40 or so seconds that the plane was diving at a speed of 200 m.p.h. They were all killed, and I have since felt that their lives were sacrificed because we had not advanced our methods of safety to



This old biplane proved its plane 'chute successful in a test at Chicago in 1929.



This is the airplane that is shown being lowered by parachute on the opposite page. The arrow points to the small compartment in which the experimental 'chute was stored.

★

The author, designer of the famed Triangle parachute, has many ponderable ideas on the need for additional air safety.

★

CAN USE PARACHUTES"

the point where a parachute for airplanes was considered a practical device.

The contempt that had been tossed in the direction of the harassed pioneers in the parachute development section at McCook Field almost two decades ago now has found a new outlet—the transport parachute. This despite the fact that planes actually have been safely lowered to earth by the silk "umbrellas"!

Several years ago at Santa Ana, Roscoe Turner's plane was successfully suspended by a parachute designed by Jimmy Russell, who was one of the civilian employees at McCook Field and an associate of mine there just after the War.

Vance Breese came down twice in his old Parks biplane in Detroit, his craft's drop effectively slowed down by a Russell 'chute. On the first day, the plane fell into a tree, suffered slight damage which was patched quickly enough for a second attempt the following day. As though he was aiming at a bull's-eye, Breese landed virtually in the middle of Grosse Isle airport, his ship nosing up and suffering little more than a splintered spar in the lower wing.

In 1932, Capt. Bill Street and I entrusted our Consolidated P-T Army training plane to an 80-foot Triangle parachute of my own design, cutting away from it after a long and successful period of suspension.

The idea was hard to sell in those days because hard-boiled airplane manufacturers wanted nothing to ruin the aerodynamic efficiency they were rapidly learning to attain. And since we felt that a "plane-'chute" should lower an airplane as slowly as an individual 'chute lowered a person, they were necessarily so large and bulky for comparatively small ships that, in stowing the 'chute in fuselage or wing, a bulge would inevitably occur. The manufacturers couldn't be blamed for snorting at something like that.

I admit that I continued to labor under this delusion for a long time before a spectacular, accidental occurrence brought me suddenly to the problem's solution.

Last year, a 23-year-old parachutist named David Binns went up with Pilot Cliff Haney in a Ryan S-T from the Port Columbus, O., flying field to make his 73rd jump, the opening feature of a village fair.

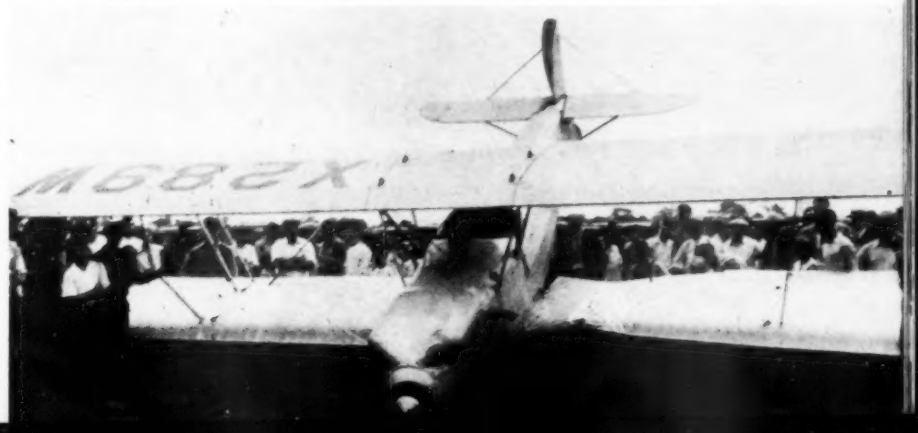
At 5,500 feet, Binns crawled out, prepared to jump. But, in some manner, the cover on his parachute pack caught on the cockpit, the pilot 'chute leaped out and a moment later the main 'chute began to open. It fed back under the tail group brace wire, yanking Binns off the plane, which had been nosed up into a stall to prepare for the jump. He was pulled against the fuselage near the tail, unable to free himself. With the controls jammed as a result, Haney jumped and came down without injury.

But in the meantime, the plane and 'chutist both were being lowered by the same parachute! The Ryan fell into a steep dive, decelerated, however, by the air brake action of Dave Binns' chute.

When rescuers reached what they thought would be a smouldering mass of wreckage and a dead stunt man, they found Binns unconscious, lying across the tail. The plane had rolled over on one wing after landing on its nose with far less than the terrific force expected. The motor was damaged and the propeller was split, but the fuselage survived, in the words of Foster A. Lane of the Port Columbus Flying School, "with several ripples in the skin."

And Binns, hardly any the worse for the experience, showed up at the airport the next day, complaining only of soreness and stiffness!

This vividly demonstrated that plane-'chutes need not have a tremendous spread to save a plane from total ruin and its occupants from certain death. David Binns' ordinary 28-foot parachute so greatly eased the shock of striking



At right is Vance Breese's ship at Detroit after being lowered by its 'chute.

the earth that the 'chutist sustained no serious injuries and the plane was not demolished.

On the basis of past experience with plane 'chutes and with the Binns episode as practical proof that smaller canopies will do the job effectively, I am certain that parachutes for transports can be stowed in the fuselage near the center of gravity without the objectionable hump, can be "launched" simply and quickly in case of emergency, and can cushion the fall of a large plane to such an extent that every passenger will survive and 75 per cent of the craft will be undamaged.

There are two general classes of parachutes—those designed for saving one individual, and those designed for saving a group of persons in a plane. An individual may easily free himself from a disabled small plane and save his life in a parachute jump under circumstances somewhat similar to those which would send a transport crashing to destruction, with a great number of fatalities.

Because passengers in large planes seldom can leap in time, their fate rests entirely on one factor:

How hard will the plane strike the ground?

After all, what kills transport passengers in a crash? Simply the bone-crushing impact with the ground. The faster a plane is traveling in a forced landing or an uncontrolled dive, the harder it will hit and the higher will be the fatalities.

Man can withstand a jar to his body of a certain amount. If he is smashed against an object harder than this amount, he dies; if he strikes an object more gently than his maximum ability to withstand collision, he lives.

The justification of a plane-'chute is as simple as that.

A plane-'chute will keep a disabled transport from landing with a force beyond the ability of the body to absorb with impunity.

For instance, most any person can withstand a free jump from four feet above the ground; others, ten or more feet. The problem of relatively safe aviation resolves itself fundamentally, then, into providing that under all circumstances man will never strike the ground with such force that the resultant shock to his body will be greater than that caused by a jump of, let us say ten feet high or thereabouts.

The plane 'chute is the only means by which this can be accomplished feasibly with heavier-than-aircraft. No matter what improvements are made in heavier-than-aircraft in the way of lighter engines, greater speed range, lower landing speed, stability, better climb, better navigation, slow vertical ascent or descent, more reliable motive power, or what-not, the fact that the machine is still heavier than air makes it imperative that it be parachute-equipped. Something can and may happen to it—breaks may occur in fuselage, wings, ailerons, elevators, rudders, control sticks, control wires, fittings, propellers, or the engine may die due to any of dozens of causes—and in this situation only the plane 'chute will keep lives from being snuffed out and the craft from spreading out all over the landscape.

What about small private planes, two to six-passenger jobs? Access to the outside is much easier than in a transport; the passenger can jump quickly in an emergency. But, assuming that the passenger is equipped with a parachute, which is in most instances not the case, will he jump? In the casual air traveler, in the person whose daily workshop and playground is not thousands of feet above the ground, rests a terror of falling free. His mind will tell him that he will die if he remains in the plane, but the involuntary reaction of his muscles and nerves will more often than not keep him rooted to his seat.

An army flyer some time ago was

"Ever since he found that old roller skate he's been practicing landings . . ."

flying across the Oregon forests with a newspaper reporter as passenger. The motor stopped at a considerable altitude and the pilot had absolutely no field in which to land. He got out on the step and tried to drag the newspaper man out and make him jump, too. The latter, ashen-faced and trembling, hunched down in the cockpit and wouldn't budge. The pilot, of course, was in no position to stage a debate in a plane rapidly falling out of control. So he climbed back in, glided down and crashed between some trees, wrecking the ship entirely and injuring both himself and the horror-stricken journalist. Adapt this incident to the average privately-owned cabin plane, and you will see why a plane 'chute can be a mighty valuable safety mechanism.

Aside from structural or engine failures, there are numerous situations in which a plane 'chute might be used. For example, fog has been the cause of many fatal plane accidents, and although with certain equipment, an experienced pilot may fly safely through fog, the average airplane owner is seriously handicapped by it, especially when making landings.

Forced landings at night or in bad terrain, even in broad daylight and under good weather conditions, can very easily be fatal despite the most expert handling. A plane 'chute would soften the impact.

Mid-air collisions usually throw both planes out of control immediately. Nothing but a plane 'chute device might save the lives of those involved. Ice or sleet, which make flying dangerous under certain conditions, may cause a pilot to rely on the plane 'chute.

In the design of a 60-foot plane 'chute capable of carrying a six-passenger plane, Jimmy Russell and I have incorporated what we believe revolutionary features in 'chute construction to meet the peculiar problem of launching the device.

We have reached the conclusion that the main supporting parachute should be housed in the top of the fuselage as close to the center of gravity as possible, and the decelerator 'chute should be stowed in the tail, the only position from which it can be released with certainty in all attitudes of the plane, including flat spins as well as ordinary tail spins.

With the pilot 'chute tugging at the main canopy, the mouth of the latter naturally is pulled together. In the ordinary round 'chute, inflation is caused by the inrushing of air through the mouth, a method that would be too slow for the successful operation of a huge plane-'chute.

As a solution, three rows of valves were designed. They encircle the 'chute and allow air to rush in through the *outside* rather than the *inside*. The 'chute will balloon out even if the mouth is tied shut, an impossibility in the present round canopy types.

Increase the diameter of this 'chute to a suitable size, and it will carry a DC-3 to earth at a landing speed of about 25 miles per hour. At that speed, passengers are far less liable to suffer serious injury or death than in the velocity or ordinary forced or crash landings. Remember that Dave Binns was only slightly bruised when he struck the ground at 38 miles an hour. and his Ryan hit nose on.

An airplane is its own shock absorber. For equal amounts of bodily jar, a person can strike the ground much harder if he is sitting, or better still, standing in an airplane, than he ever could on the end of an individual parachute. In the latter case he has only the flexibility of his knees to absorb the shock; in the former, the tires, landing gear, fuselage, chair and seat cushion all tend to reduce the jar. That convinced us it is not necessary to lower planes as slowly as individuals to afford similar protection. And the problem of bulky plane 'chutes disappeared.

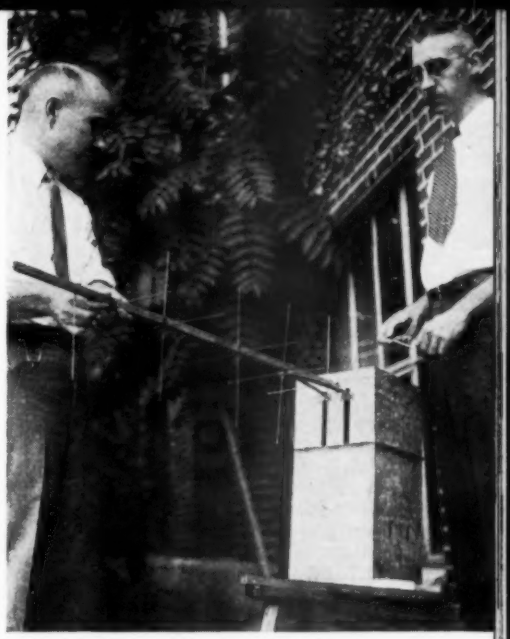
I sincerely believe that men like Knute Rockne and Senator Bronson Cutting—

(*Continued on page* 85)

Radio Lights

by HERBERT H. HEIMLICH

Two Purdue University scientists have what may be one answer to the blind-landing dilemma.



R. H. George (left) and H. J. Heim making an outdoor test with their transmitter.

SOME way to guide airplanes to safe landings through fog and clouds would relieve aviation of one of its most serious and at the same time, most stubborn problems. Two Purdue University scientists at Lafayette, Indiana, now appear to have solved the problem.

Credit for the achievement, one of the most important contributions to aviation in some time, goes to R. H. George and H. J. Heim, of the university engineering experiment station.

"Radio Lights" is the name given the new development, which promises to add immeasurably to the safety of flying. Planes have been kept on the ground for extended periods at times because of fog, with accompanying inconvenience to the traveling public and loss to the airlines. In addition, clouds and fog have been the cause occasionally of crashing into mountains and also of mishaps in landing, with loss of life and heavy damage to ships.

Scientists have long been at work on the problem. The bent beam is one contribution to the solution, but radio lights are said to be an improvement, in that they will enable the pilot to know how far he is from the field, as well as his relative position with respect to the runway.

The new lights are designed to permit the pilot to land his plane on the airport runway, no matter how completely fog or clouds may obscure the ground, with safety and unquestioned certainty that everything will be well.

Messrs. George and Heim, as an important part of the new device, have developed a short wave transmitter, several of which (perhaps three) will be placed on either side of a runway. Each transmitter is a miniature radio station, sending out signals toward the incoming plane.

Special equipment in the airplane converts these signals into spots of light on a round glass screen, placed on the instrument panel, which is similar to a television screen. These lights on the screen are in the same relative position as the transmitters are to the runway on the ground and thus, in a sense, enable the pilot to "see" the runway. Further, he can determine the direction from which these radio waves are coming and also whether he is approaching the runway head-on, crossways or at an angle.

Thus, by means of the transmitters and receiver, the pilot will be able to guide his plane straight to the runway, and be sure that he hits it right. It is expected the lights will guide the pilot so well, that he will not have need of an altimeter in determining how close he is to the ground. The distance the pilot will be able to "see" the lights will be determined by the amount of power used in the transmitters, but it is hoped to make them visible at least ten miles.

In addition to guiding the pilot to a safe landing, the lights may also be used to mark courses over mountains and through mountain passes, eliminating another flying hazard.

The transmitters contain high frequency tubes, set between resonant circuits of copper. Extending from one side of the transmitter is a wooden support, to which are fastened antennae and also radiation directors, which are an adaptation of the Yogi directors.

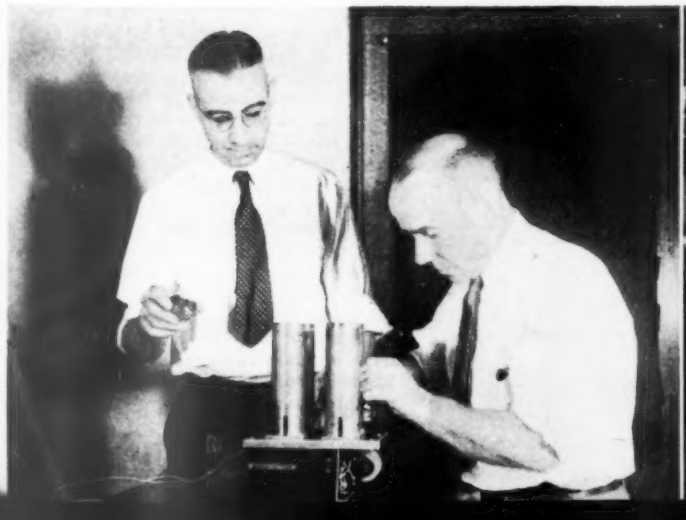
The Purdue scientists are not novices in the field of radio and electrical engineering, and Professor George especially has made important contributions to both. He spent most of last summer making experimental flights in the Rocky mountains, out of Salt Lake City, under the sponsorship of certain commercial airlines. At this time he studied the problems presented to aviation by fog and clouds, and also observed other difficulties. One of the results of these first-hand studies is the radio light.

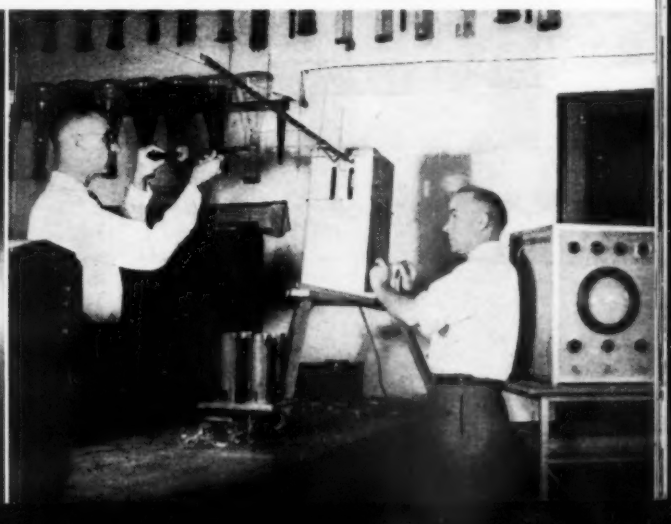
Mr. George was the first to develop television pictures in black and white, and is in charge of the Purdue television station, WXYZ, which broadcasts programs twice a week and has been in continuous operation longer than any other similar station. Further, during his 15 years at Purdue, he has made important contributions in developing the cathode ray tube, and also the cath-

(*Continued on page* 89)

Below, Heim (left) and George are shown assembling the resonant circuits that will go into their transmitters. Heim holds a special tube.

The Radio Lights transmitter is mounted on a three-legged platform. Right is a cathode ray oscillograph for tests.





BIG

IN THE teeth of a 250 m.p.h. wind a plane banks and turns, climbs and dives, yaws and rolls, but below it seven "electric eyes" watch seven electric balances and instantly record on a meter board every force acting on the plane. The plane is "flying" in the largest and most up-to-date wind tunnel owned by any college or university. The $150,000 concrete structure, located adjacent to the Aeronautical School at the University of Washington, promises to be of such aid to the school and industry that the Boeing Airplane Company has furnished $26,000 as advance rental for use of the tunnel.

Replacing an old four-by-four foot tunnel with a maximum airstream velocity of only 100 m.p.h., the new structure embodies the latest developments of tunnel design, based on a study of the equipment in use at Langley Field and the California Institute of Technology. Accommodating a model of 10-foot wingspread, the tunnel is larger and faster than those in any other schools. Next in size are those located at Massachusetts Tech and California Tech, the only larger ones being the two operated by the National Advisory Committee for Aeronautics and located at Langley Field, Virginia.

The reinforced concrete structure was designed by the faculty of the Aeronautics Department of the University of Washington, with Prof. F. K. Kirsten in charge, and was completed at a total cost of about $150,000. The tunnel proper, consisting of a central passage and two air return passages in a horizontal plane, is elevated one story above the ground. This feature allows easy access to the machinery and provides space for computing rooms and a research laboratory on the ground floor.

Size of the wind tunnel's 20-foot vanes is graphically shown by comparison to the figure of Prof. F. K. Kirsten. These vanes cool and direct the air through the tunnel.

Above is a scale model of the Boeing B-17 Army bomber mounted in the new wind tunnel.

Prof. F. S. Eastman (right) invented the new tunnel's delicate electric balances.

The air passages are aluminum painted and amply lighted with recessed tube lights. At eight right angle turns hollow steel vanes, 20 feet and 13 feet in height, direct the air around the corners. The vanes serve a dual purpose. Not only do they direct the air but they cool it as well. The 1,500 h.p. imparted to the air by the two propellers develops as heat caused by friction of the airstream on the walls of the passages. This heat is removed by circulating cold water through the 108 hollow vanes.

Two 15-foot propellers, located in the air return passage, provide the power for driving the air past the model in the restricted or test sections of the tunnel. Each propeller is made up of seven black walnut blades shaped at the university. The variable pitch blades, of a unique tear-drop cross section, reduce wind resistance and increase the efficiency of the propeller. They are mounted in a duraluminum hub covered

WIND

by VERNON W. CHESTER

The University of Washington's new wind tunnel is so good the Boeing company has invested in it.

by a special spun aluminum spinner cap.

Two 500-750 h.p. direct current motors located outside the tunnel drive the propellers through silent spiral bevel gears. These motors are capable of producing an air speed of 250 m.p.h. at the test section of the tunnel. Provisions have been made to add additional power to produce an air speed of 320 m.p.h. if such a velocity becomes necessary for future research. The propellers are located in the air return passages to protect them from possible injury from broken planes and parts.

A movable remote control panel, located near the balance instruments, controls the speed of the motors. On it are meters registering speed and power intake. Four push-button type switches control starting, acceleration, deceleration and stopping.

The test section of the tunnel is a restricted portion in the central passage. The air, driven by the propellers in the air return passages, travels around the corners and through the directing and cooling vanes and enters the restricted passage known as the Venturi duct. This restriction causes the air to attain a high velocity. The test section of the Venturi duct is of a rectangular cross section with faired corners. This section has removable wooden walls with heavy glass windows.

The test section will accommodate a plane with a wing spread of 10 feet. The model plane or part is mounted on three prongs extending upward through the bottom of the chamber. With this system, a model can be mounted in 15 minutes—a great saving in time from the old method of attaching many wires to the plane.

A unique system is used to control the model. The plane can be made to climb, dive, bank, turn, roll and yaw, by manipulation of oil pressure valves which control hydraulic cylinders that move the model. The control valves are located on the balance table, hence every movement of the plane is at the operator's immediate command. The position of the plane is indicated on the meter panel at all times.

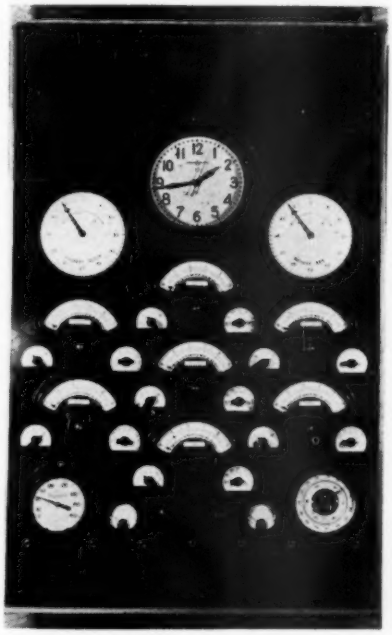
Below the Venturi tube and directly under the model is a large casting with a hollow central core. This forms a foundation for the model and houses the delicate mechanisms for manipulating and measuring the forces on the plane. On an arm of this casting are located seven sensitive electro-magnetic balances invented by Prof. F. S. Eastman. These automatic Kelvin balances, instantaneously measuring lift, drag, roll, side-load, pitch and air velocity supply just enough current to balance the aerodynamic forces. The balances are "read" by a light beam and photo-electric cell mounted on each.

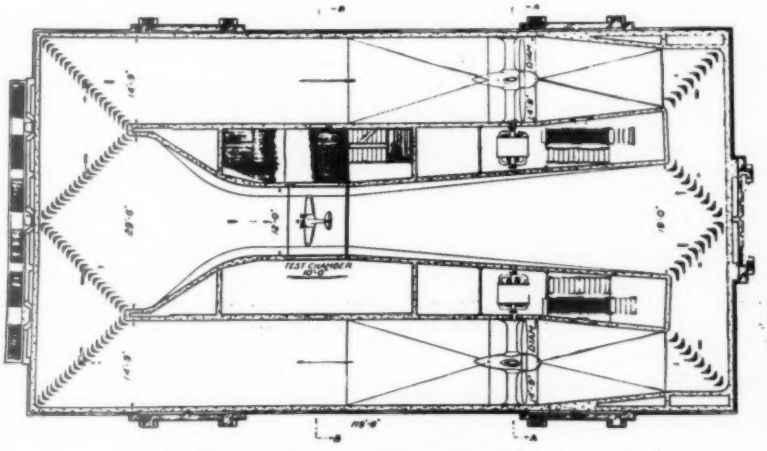
Readings of the positions of the bal-

(*Continued on page* 89)

Professor Kirsten, the tunnel's designer, illustrates the size of one 15-foot prop.

This huge meter panel is photographed while in operation to obtain test data.





A plan drawing of the new tunnel, looking through the roof.

The Forest Service's new Stinson at Oakland airport.

Winged FIRE FIGHTER

by F. LELAND ELAM

Uncle Sam's Forest Service thought the airplane useful enough to spend $15,000 for one recently.

THE airplane is one of the most important fire control units of the United States Forest Service.

Experimental work has been conducted for several years to determine the most practical and useful ways the airplane could help in such work. Some of its uses have been perfected while others are still in their experimental stages.

To help perfect those in the experimental stages and to help apply the uses already developed, the Forest Service recently bought its first airplane.

The No. 1 plane of the Forest Service is a fire fighting laboratory airplane. Into it are built the features which experimentation has proved to be most desirable for fire control work from the air. "The fire truck of the air" it has been termed by many, but the term is only figurative for in no way is it a "truck." The sleek green-coated high-winged cabin plane is a new $15,000 Stinson *Reliant* purchased on bid. As No. 1, it is the first of what may eventually be a fleet of Forest Service fire-fighting airplanes. The plane will be stationed at an airport near the Pilgrim Creek Nursery in the Shasta National Forest, McCloud, California. Personally operating it will be its engineer-pilot, Captain Harold C. King. The entire project is sponsored by the United States Forest Service in Washington, D. C.

As project leader, Fred W. Funke of Government Island, Oakland, operating under orders from Regional Forester S. B. Show in San Francisco, will use the plane to develop, through experimentation, work started two years ago on the dropping of chemical or water bombs on forest fires to help control them.

This phase of the work is one of the most important the plane will have to perform. It is expected that the proper technique will be developed with the new plane so the use of chemicals dropped from the air can become general in use throughout the United States Forest System.

(Bombing of forest fires from the air is demanding considerable attention everywhere, but little information has been released on the subject by the Forest Service. Officials will not commit themselves readily on findings on subjects which are in the experimental stages.)

"Developments in aerial fire control technique have not been widely known," Regional Forester Show stated, "due to the fact that successful completion of early experiments could not be predicted. However, preliminary experiments indicate that it is entirely practicable to fly over small fires even at high elevation in rough country and with the aid of various sighting and release devices which have been perfected by the men engaged in the experimental work, drop water and other fire retardents on the fire with a high degree of accuracy."

As a companion project basic chemical research is being conducted by the Forest Service in eastern United States to determine the most effective combination of chemicals to retard fire spread. While considerable progress has been made, the chemical phase of fire fighting is still very much in the laboratory stage according to Show.

Reports coming from men conducting these experiments are that they have put out small fires just starting by dropping chemicals on them from the air, while other fires not of larger area than ten acres have been retarded sufficiently by dropping chemical bombs at their edges with direct hits so that ground crews found it easy to control the fire in a small area when they arrived.

The problem of flying close to small fires in mountainous country presents many difficulties due to uncertain wind currents and rough air. It is necessary to fly at elevations anywhere from 300 to 800 feet. Creation of air pockets, severe up and down drafts by the fire make the work exceedingly dangerous.

Many technical aspects of experiments to control forest fires through the use

The cabin is 12 feet long, soundproofed and will carry a 1,250-pound cargo and a crew of two. The photograph shows the special door arrangement for loading equipment.

This closeup view shows the novel blister outside the window, "bomb" release near strut.

of airplane bombings have been worked out and conducted with private airplanes contracted by the Federal Government for Forest Service work. While these experiments have determined the practicability of dropping water and chemicals on small fires to retard the spread, the proper technique for bombing, the approach of the airplane, and many other factors to insure continuous successful bombing must still be worked out.

The progress of the fire control work by bombing last year indicated that continued experimentation is justified and the No. 1 Forest Service airplane was planned and eventually purchased to do the more advanced work on bombing experiments as well as other phases of fire control from the air.

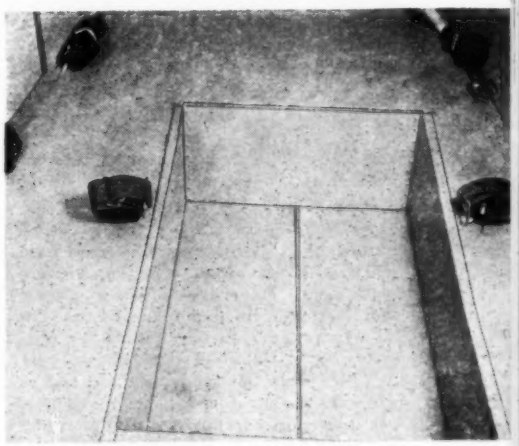
"United States foresters throughout the country have looked forward to the purchase of this plane," stated Forester Show. "It will fill a long-needed place in the advancement of experiments in aerial fire control technique and in the suppression of forest fires."

Into the plane is built several features which made it necessary for this standard Stinson *Reliant* to take a new air worthiness test before Air Commerce inspectors. One of these is a special bomb sight designed for accurately dumping chemical bombs, food and fire fighting equipment from an installed cargo bin or hatch. The sight is called a "blister." Actually it is a large windshield attached to the outside of the plane over the right side cockpit window. This allows the observer or bomber to look both ahead and directly down at his target and at the same time gives him protection from the wind. On the outside just below this "blister" is a handle for releasing the bombs or other materials from the cargo bin.

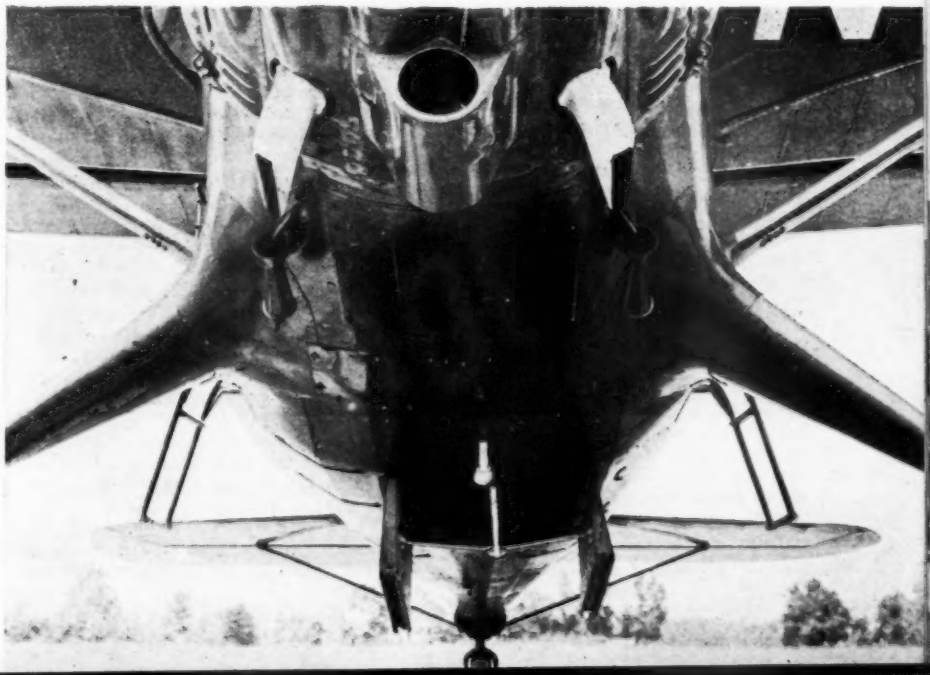
The bin was another new feature which required the plane to have a air-worthiness test. From the bin two doors open outward in the bottom of the plane forming an exit from the hatch. It is these doors that are worked by the bomb release handle. Any substance placed in this bin is shot toward the target when the doors are opened by the bomber sighting from the "blister."

Another feature of the plane is a double door affording a large opening on the right side for loading large cargo such as rakes and shovels. There is also a small cargo door on the same side. This door is designed for use when the passenger seat is in place behind the cockpit seats.

This novel Stinson is equipped with a latest type Hamilton-Standard con



Above is "bombing" bin in the ship's floor.



The "bomber" leans out the ship's blister, aims, yanks release opening doors (right).

stant-speed propeller. The cabin is 12 feet long, soundproof, and fully ventilated. It will carry a 1,250-pound cargo and a crew of two. An extra seat can be arranged for three passengers. Rate of climb at sea level is 1,500 feet a minute. Service ceiling is 22,000 feet and flying range is 800 miles. Wing flaps and brakes are designed to permit a landing run of 400 feet on emergency areas. Tires are puncture proof. The motor is a Pratt & Whitney *Wasp* with 450 h.p. available for take off and 350 h.p. for cruising.

Besides experiments to develop technique in control of fires by chemicals, the new plane will further experimental work in taking pictures of fires for immediate use by fire bosses; in the use of a voice amplifier system from the airplane; and in additional investigation of laying supplies down by parachute at fires and in remote Forest Service camps.

Experiment work on pictures will include taking of pictures of different angles of a fire. The film will be dropped in a camp where they can be developed immediately and prints delivered in a few moments to the fire boss so he can see the characteristics of the fire he is fighting.

Some work has been done on the projecting of the voice from an airplane to the ground by means of a voice amplifier. The new plane will further present accomplishments.

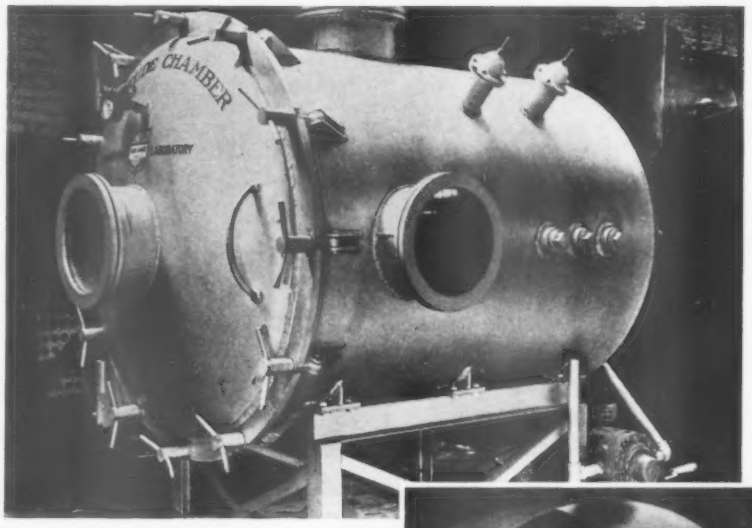
Fred Funke, project manager, who recently returned from a trip over the Stanislaus National Forest in California where airplane broadcasting tests were made says, "Experiments with the voice amplifier indicate that it is adequate for all Forest Service communication purposes for which it is expedient to project the voice from an airplane to the ground. I believe it will have a definite usefulness in searching for and directing lost persons and organized crews engaged in such work; directing fire line crews to spot fires which may be located from the air; warning fire crews of impending danger; directing fire crews on the line when sudden changes in condition of the fire are observed from the air, and in other emergencies."

The voice amplifier used by the Forest Service is the Coast Guard type and complete with battery weighs 305 pounds. A triple speaker unit drives a single metal horn which is placed over the side of the airplane and directed towards the ground. A message can be given to men on the ground by the operator in the plane from an average distance of 1½ miles. When the motor speed of the plane is cut to a low cruising range the voice is clearly projected by the amplifier. Ground cover of timber or brush, or a mixture of the two, has no absorbing effect on the transmission, and topographic conditions such as deep canyons and mountain slopes produce only a negligible amount of reflection and echo.

Tests will be made in the use of the

(*Continued on page 76*)

Stratosphere Comes to Earth



"FLYING" in the stratosphere is nothing new to United Air Lines engineers who have been "climbing" to "65,000 feet" quite regularly of late—without ever leaving the surface of Chicago's municipal airport. No, it's not a gag; it's the elaborate pressure chamber shown directly above. In it, the airline's engineers are able to simulate conditions as they would be at altitudes up to 10 miles high. This is done by the evacuation of air from the chamber until the air pressure inside equals whatever altitude is sought. Air is withdrawn by mixing it with water, then discharging the water. The chamber will be used for testing various equipment at high altitudes. The men in the inset are testing an oxygen-inhaling mask.

U. S. Aircraft Production Rises

THE number of aircraft manufactured in the United States in the first half of 1938 was approximately 22 percent greater than that for the same period last year, according to production figures made public today by the Civil Aeronautics Authority. The total of all aircraft manufactured in the United States in the first six months of 1938 was 1,974 as against 1,623 for the same period in 1937.

While the total of all aircraft manufactured increased, there was a 21 percent decline in the number produced for domestic civil use. The greatest gain occurred in military production. This was 173 percent. Export production increased 49 percent.

Of the total of 1,974 aircraft built during the first half of this year, 853 were for domestic civil use, 694 for the military services and the Coast Guard, and 427 for export. The 1,623 total production for the first six months of 1937 was divided as follows: Domestic civil use, 1,083; military and Coast Guard, 254; and export, 286.

From January-June of this year, the industry manufactured 780 monoplanes and 73 biplanes for domestic civil use. The 780 monoplanes included 750 cabin and 30 open cockpit planes. The biplanes included 55 of the cabin type and 18 open cockpit.

A tabulation of total production for January-June, 1938, follows:

MONOPLANES:	
Cabin type (landplanes)	
1 place	41
2 place	616[2]
3-5 place	98[3]
6-8 place	11[4]
10 place and over	21
Total	750
Open cockpit	
1 place	15
2 place	15
Total	30
Total monoplanes	780
BIPLANES:	
Cabin type (landplanes)	
2 place	3
3-6 place	52
Total	55
Open cockpit	
1 place	14
2 place	3
5 place	1
Total	18
Total biplanes	73
Total domestic	853[5]
For military use, including Coast Guard	694
For export	427
GRAND TOTAL	1974

[1]Includes 2 convertible planes (open or closed).
[2]Includes 8 convertible (land or sea), 2 convertible (open or closed), and 1 amphibian.
[3]Includes 1 convertible (land or sea) and 1 amphibian.
[4]Includes 1 amphibian.
[5]Includes 28 multimotor craft.

The Beco-Brown, still carrying its NX, about to take off on a test flight.

For Mr. EVERYMAN

by WILLIAM B. RYAN

There is nothing fantastic about this airplane. It simply has many of the best features found on various types around the world.

WHEN Eugene Vidal, some years back, decided that the world be prepared for a "poor man's airplane," he set a tentative price of $700, thereby driving most aircraft manufacturers to despair, and himself out of the Department of Commerce.

Last month Larry Brown, Los Angeles racing plane designer, and Harvey A. Beilgard brought forth what they claim is the first real "poor man's airplane" above the lightplane class, but set the price at a realistic "less than $4,000." To reconcile this initial cost with the "poor man" definition, they pointed to a shipful of safety gadgets, designed around the idea of one-man operation. "The airplane as we will build it," says Beilgard, "will show increases only in usefulness to its operator. It will not be particularly fast, but it will be safe. It will fly to San Francisco from Los Angeles in five hours, carrying two people comfortably. It, unlike low-winged airplanes, can be landed in high weeds without injury to the wing. Its slots and flaps make it as nearly foolproof as an airplane can be without being impractical."

Beilgard admits that most of the features of the Beco-Brown are merely adaptations from old-time ships which have proved their worth. "We have taken a lot of ideas and assembled them on one airplane, trying all the time to keep costs down." Appointments, in keeping with this cost idea, are simple. Shock cord, instead of oleo strut, is the rule. The steerable tail wheel is so swiveled that the pilot can easily push the ship around by the vertical fin, steering the tail by the rudder counterbalance.

Gross weight of the Beco-Brown in its present experimental state is 1,675 lbs. Weight empty is 1,100 lbs. Though complete performance statistics will not be released until flight tests are completed, the ship is said to cruise at 100 m.p.h. with a Lambert "90" in the nose.

Looking very much less modern than many an older airplane at first sight, the Beco-Brown nevertheless includes most of the features that make a modern airplane. The large windshield, of Plastacelle, stands almost straight up and down and the nose disregards sweeping lines to achieve narrowness and visibility. Exhaust fumes empty into a tailpipe which carries them well back of the cabin. In flight, the airplane takes off normally. After a decent run, it flies off and climbs well without sacrificing forward speed. Its large flaps, plus the Handley-Page slots, bring it in to an exceptionally short landing.

It seems logical to assume that an airplane of this type would be the answer to the lightplane pilot's demand for "something a little heavier", yet just as safe.

END

Test Pilot Russell Hankforth and Harvey Beilgard (hand on wing) inspect the L-5.

Beilgard demonstrates at right the ease with which one man can push ship around.

Bernard (inset) and his airport above, are criterions of rugged individualism.

PILOTS' GODFATHER

by LESLIE LONG

One man still can do a lot for private flying, though single-handed. Charlie Bernard has.

WHAT private flying in this country needs is more men like Charlie Bernard. All great movements in the arts and sciences have had their guiding stars—their Joshuas in the wilderness, so to speak. Such movements seem to require a leader, a sort of crusading evangelist who is always there when the going gets hardest, who says little and does much, who asks little and usually gets less than that. As a candidate for a seat with this group of little-appreciated heroes we herewith present the name of Oregon's own Charles Bernard.

In many ways Oregon is unique among the states of the Union. It has a large part of the world's supply of airplane spruce and very few airplanes. It has a long stretch of vulnerable coast line and not a single airpalne base to protect it. It has the only outright, acknowledged and working state aviation law in the United States. Oh, yes, and don't forget—it has Charlie Bernard.

Mr. Bernard is a shining example of a man with a mission. Born and raised within a few rods of where he now lives, he had no idea of missions when, as a boy, he romped and played over the fields and meadows of his dad's ranch. When he thought of the future he hoped he would be as good a rancher as his father was and let it go at that. He was doing a pretty job of it along that line up to the time the Federal Department of Commerce decided to do a little sitting down on aviation. Up to about this time his home town of Beaverton, Oregon's airplane Mecca, had paid little attention to flying, but it so happened that a local man built a successful ship and things began to happen. The city, of course, had no public airport and as one of the Bernard meadows happened to be nice and handy the local aviators and occasional visitors began sitting down in it. That's what started it all.

Having been more or less interested in aviation for several years, Bernard at that time became an outright enthusiast. It didn't take much urging to induce him to erect a hangar for the local ship. It was not long before another ship owner wanted one and that called for another and another and so that was that. Almost before he knew it he had an airport with hangars and everything on his hands, and had found that he liked the idea very much.

It seems that there must always be some sort of fly in the ointment and Bernard soon discovered a bad one. Amateur aviation was not being treated right. Its Uncle Samuel was playfully trying to run a steam roller over it, at the same time feeding it cyanide of potassium and setting fire to its coat tails. Because he believes in justice and fair play, Bernard took this situation to heart with all the energy and enthusiasm he had. He took off his coat and went to work—and by work, we mean *work*.

He drove miles and miles contacting state legislators and senators. He talked with business men, judges and lawyers. If an amendment to the state aviation law threatened, he rounded up a bunch

of the boys and was right on top of it before it could get more than started. He worked up propaganda for the papers and got it printed, too. Things simply seemed to get done once he started working on them. It wasn't for money or notoriety, either. He believed in what he thought was right and for that reason the things he did had the force that only honesty and sincerity of purpose can bring.

After watching the boys and their ships for a few months Bernard decided to go the whole thing. He set aside his best 50-acre field and told the boys it was theirs. This took courage, considering that he is anything but a wealthy man. He did not, and does not maintain the field with profit as the objective. Hundreds of dollars were spent in levelling and drainage work. Hangars were added as needed until today there are 22 of them and they house 27 ships that mean much to private flying out here.

New hangars are being added steadily and at the present rate it will be but a year or two until there will be 50 of them. Think what that means to the other states whose amateurs have been law-ridden out of existence.

Any flyer who makes his headquarters at Bernard airport becomes at once a member of a big and happy family. Boys or girls, Charlie takes them under his wing. Their troubles are his troubles. If they happen to be short of money (and they usually are) it's okay. Have it some time, won't you, buddy? Sure! And to their credit let it be said that they get it at the earliest moment. If one of the gang happens to make a five-point landing out in the country somewhere, the phone tinkles and five minutes later you will see Charlie, with a trailer behind his car, quietly leaving for the scene of the mishap. If anything or anybody needs help, just call Charlie and the help is at hand.

The spirit of good nature and good fellowship shown by the Sunday and holiday crowds is something worth watching. Everybody knows everybody else and they work together with a wholeheartedness that is rare these days. But just because spirits are high don't think for a moment that there is no discipline. Nothing escapes the steady gray eyes of the Boss. Let some young pilot get too enthusiastic in his flying and the moment he lands he is confronted by an unsmiling, stern-faced Mr. Bernard who tells him in few words just what is expected of him. Let it be said that the advice is followed to the letter.

Charlie is 45 years old. He stands a good six feet high and weighs 225 pounds. He has the body of a football fullback and the face of a cherub. The only thing that would give any indication of his age is the mop of silvery hair that is usually pointing in a dozen directions at once. Like most big men he is quiet and reserved in actions and speech. When attending important meetings or conferences he prefers to sit in the background and listen to the others, but if things go against his beliefs he can rise and speak from the

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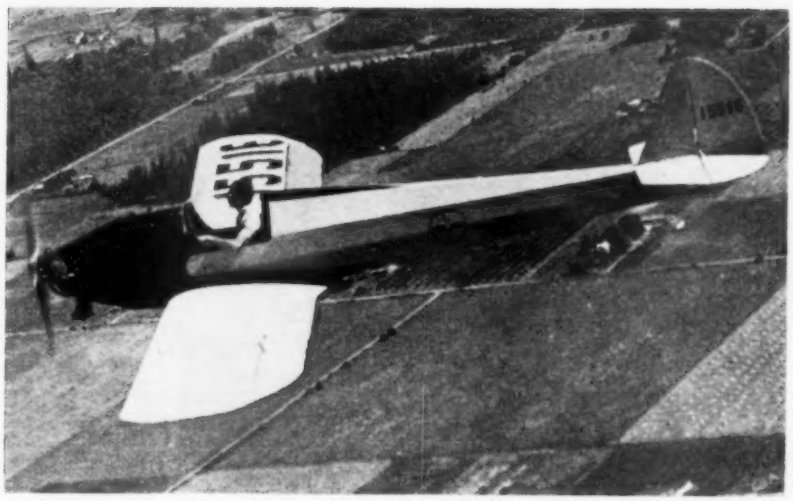


Let there be no mistake about the ability of many "home-builders." This trim low-winged monoplane was designed and built by the author, a close friend of Bernard's.

George Yates, POPULAR AVIATION's "Lightplane Patriot" (July, 1938), maintains his lively little factory on Bernard's field. A popular Yates design is shown above.

Above is another Yates product, the Yates-Fulton midwing. This and many another homebuilt design is flown regularly from and hangared on the busy Beaverton airport.

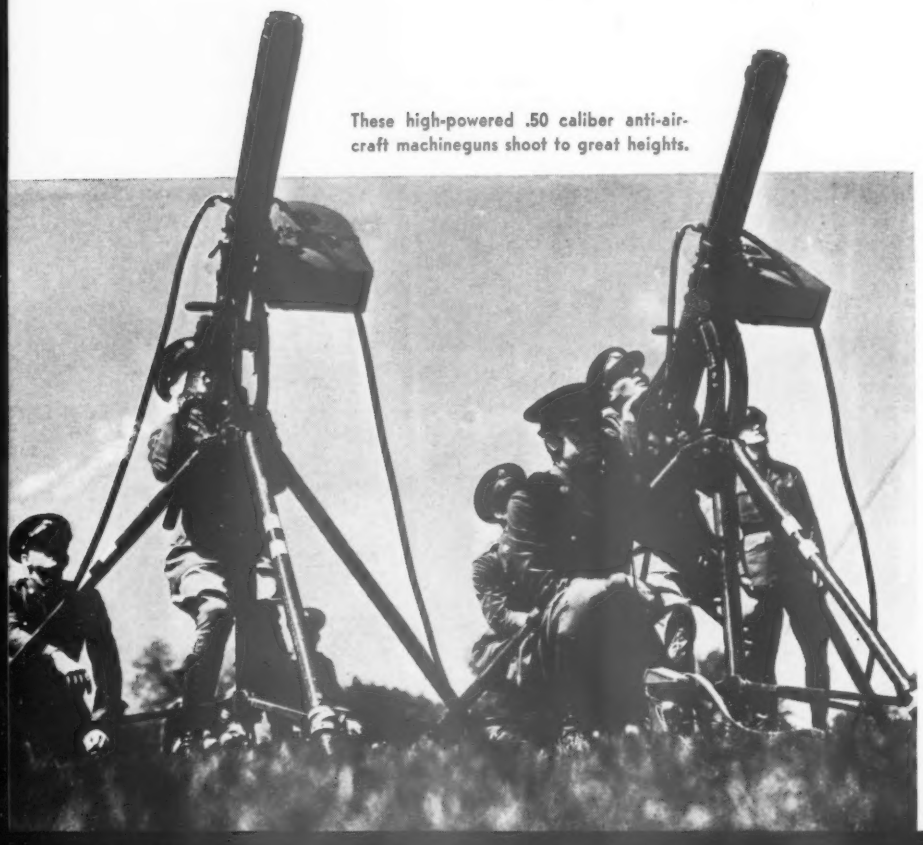
★

The GAS MODEL GOES TO WAR

Comparatively cheap to build and repair, the gas model makes an ideal target.

by ROBERT C. LUNCH

Radio-controlled, inexpensive airplanes are the goal of the Army's anti-aircraft experts. The model airplane may be Uncle Sam's salvation.



These high-powered .50 caliber anti-aircraft machineguns shoot to great heights.

DOWN on the ground a pilot sits in a little bucket shaped affair, a joystick in his hand, his feet pushing against rudder pedals. Beside him stand other pilots and flight commander, their necks craned upward, watching the flight of a pilotless plane.

Far behind the control man, anti-aircraft guns bark and bite, spitting shells into the air, trying to bring the "enemy craft" down. With a zooming climb that turns into a *chandelle,* a screaming dive, and a loop for good measure, the ship settles to the ground in a perfect three-point landing. The pilot at the ground controls grins and cuts his throttle. The propeller on the ship standing on the field slows and stops.

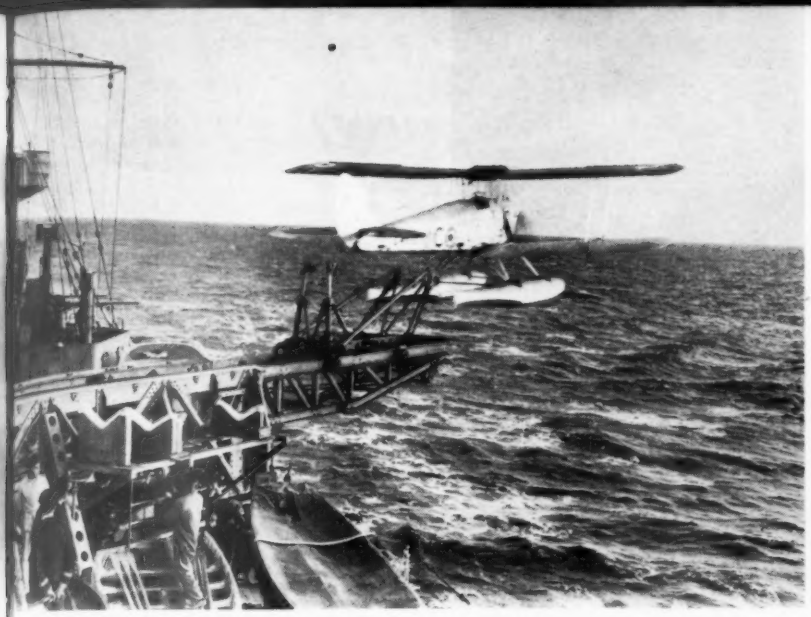
Is this fantastic or unbelievable? It is soon to be a reality. Radio-controlled craft will soon fly in place of towed targets for anti-aircraft and pursuit practice. The idea is not new, but its application in this country is a new innovation to the Army Air Corps.

In England, the *Queen Bee* and *Queen Moth,* radio-controlled planes, have provided practice for nearly four years, and though far superior to the towed target are not yet in a really finished stage of development.

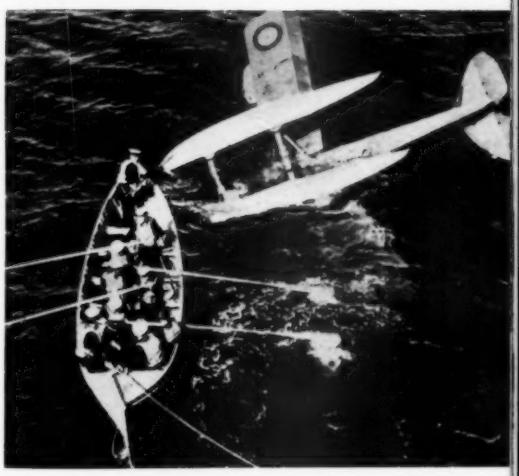
The *Queens* of England are remodeled DeHavillands, constructed entirely of wood, with the equipment enclosed in a cabin. Seven biplanes and two monoplanes of the DeHavilland design house the entire radio controlled target fleet of the British Army and Navy, though more are in the process of being built. Shooting off into space by aid of a catapult, they fly at 25,000 feet at a cruising speed of about 125 m.p.h.

Besides the weight of the radio equipment they are designed to carry two 200 pound bombs apiece, for future development of a radio controlled plane that will drop bombs behind enemy lines and return to its home base, without any pilot having to risk his neck.

With a high dihedral for stability the planes provide all the maneuvers any



The British Royal Air Force has been using full-sized radio-controlled airplanes for target practice for several years. The expense, however, is extremely high.



This pilotless target plane was shot down by British sailors, may be salvagable.

pilot can produce in actual flight, giving pilots and gunners what amounts to actual practice under as near wartime conditions as is possible.

Long ago United States Army engineers and pilots of the Air Corps looked with a good deal of longing toward the radio-controlled planes of the English government. But the United States defense budget never provided for anything even approximating the $5,000 each *Queen Bee* and *Queen Moth* costs.

The towed target, or sleeve target, is not only a costly thing in itself, but it is cumbersome and dangerous. It must fly at least a thousand feet behind the tow ship and then only in a rather straight line, toward a certain objective.

In turning, extra care is always necessary. As a troll line in water will follow a straight line, long after the boat has begun to turn, so will anything towed behind a plane go in a straight line until sometimes, the plane is actually beside the target, the entire unit looking from the ground like a U!

Then too, there was the question of fear. A gunner on the ground in time of war has no compunction about killing a pilot. But men do not kill their own pilots . . . and if they are afraid of one of their shots going a bit wild and doing just that their aim suffers and their nerves become ragged. Behind each gun an officer must stand, constantly checking and watching to see that each shot will not hit the tow plane. Meanwhile the plane in the air has moved another 10,000 feet.

"No," said the officers, "we must have something better."

The best thing available was a reproduction of an English radio-controlled plane. But the price was prohibitive. Some two years back the possibilities of the plane had been demonstrated at the Muroc Dry Lake in California. The observers were as enthusiastic as the demonstrators. But the Congress was not so eager to appropriate the money necessary.

Finally, however, the Army hit upon a plan that would give all the advantages of the *Queen Moth* or *Queen Bee*, at low cost.

Several Army officers had been detailed to attend a model airplane meet, acting as umpires, starters, and so on. As the gasoline-powered models soared upward one of the officers craned his neck. "Very realistic," he muttered.

The model of an Army attack and pursuit ship was screaming overhead, on its way down now, out of gas. From the ground it could hardly be told from a real plane flying at about 25,000 feet.

"If only we could control models by radio," he said to his fellow officer, "we could do better than the British."

Not long afterward an invitation to attend an exhibition of a radio-controlled model was tendered the Army. At the Muroc Dry Lake bed in California the 12 foot model zoomed and looped, the pilot sitting on the ground with a real joystick and rudder control.

Immediately it was snapped up by the Army and filed in their war preparations division marked "Confidential." The story was unfolded in Washington a bit the other day by the Army's issuance of bids, calling for prices on making these radio controlled craft, and giving exact specifications of the craft itself—but not the apparatus for control.

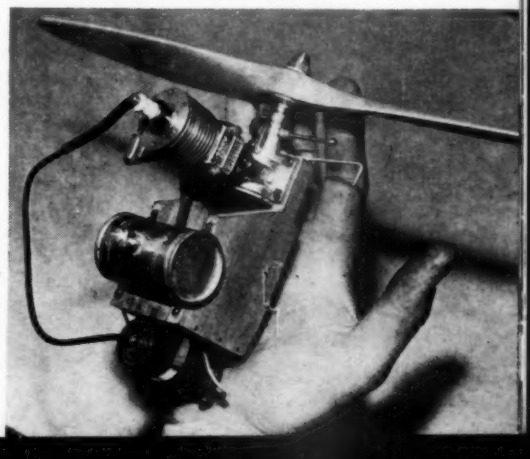
Since the aircraft, from the ground, must offer relatively the same target as would a pursuit plane at 2,500 feet, by mathematical means it was determined that a model with a wing spread of 12 feet would be about right.

Overall the planes will be nine feet, carrying one of the model gasoline engines on the market today. The design has been worked out secretly, and is understood to be a cross between the fast pursuit ships used by the Army today, and the older Spads of World

(*Continued on page 87*)

Reginald Denny, the gas model-building Hollywood star, has been known to have been working toward the Army's anti-aircraft target idea. That big model spans 12 feet.

For military purposes, this tiny Cyclone gas engine would save the U. S. large sums.



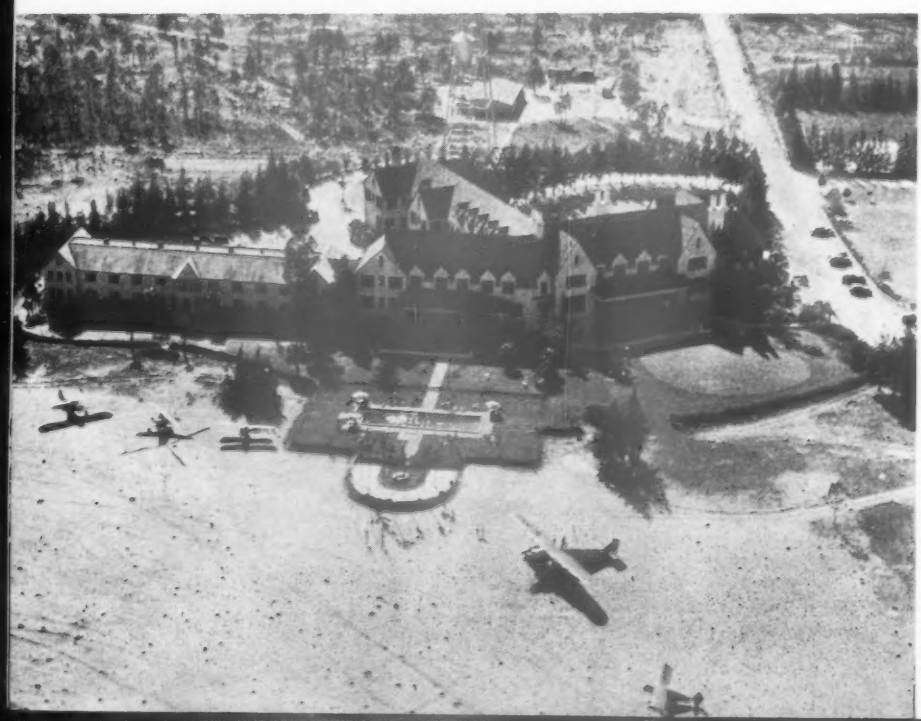
The world's largest airplane hangar is at Pan American's base near Miami.

FLORIDA *SPROUTS WINGS*

by JOHN FORNEY RUDY

The Everglade State has definite progressive ideas about aviation. The campaign has started.

The hotel at Mt. Plymouth demonstrates its air-mindedness with its own airport.



"WE must sell aviation to our public! We want and expect our Florida people to be thoroughly air-minded!"

These words hammered into the ears of an audience at Montgomery, Ala., last April. The audience was the Southeastern Aviation Conference; the speaker, G. Wayne Gray, president of the Florida Aviation Association . . .

The history of Florida's remarkable air progress goes back to 1933, when Maj. A. B. McMullen, now Chief of the Airport Section, Bureau of Air Commerce, was Florida's state aviation director. Under his capable direction, from '33 to '36, Florida led the entire nation in number of airports constructed.

Although aviators call Florida a *natural* insofar as perfect flying conditions are concerned, Major McMullen first saw the need of popularizing aviation in order that the "little fellow" might have his chance. The All-Florida Annual Air Tour came into being in 1933. At that time it was held by sportsman-pilot and private flying associations, not only from Florida, but from all sections of the nation, mainly enroute to the air races held in Miami every winter.

Other Florida cities looked on enviously as Miami continued to attract hundreds of ships and pilots each season. It wasn't long until some of these other cities began staging events prior to those held at Miami, to attract the northern fliers before going on to Miami. Mt. Plymouth, a small city in central Florida, installed an airport adjoining their golf links and swimming pool. Flyers could land at the first green, have a round of golf, a refreshing swim, and then be on their way again.

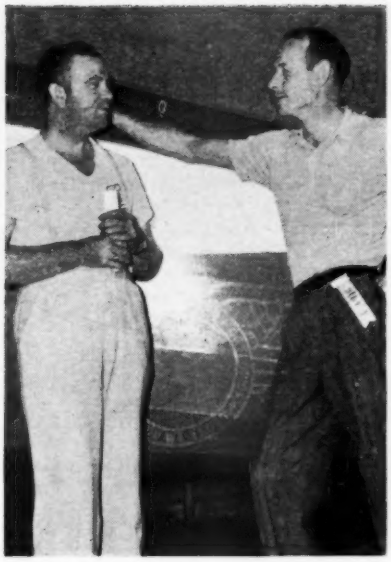
This sort of aviation growth produced ill-effects. Each city commenced a rivalry that was more harmful than good, producing a provincial outlook on aviation activities. They were for themselves first, and state aviation second.

In 1935, G. Wayne Gray, a lawyer, a city commissioner of Orlando, and an aviation enthusiast of the first water, was having his own personal battle with other city officials in an attempt to enlarge the local airport. If this could be accomplished, Eastern Air Lines could be persuaded to make it a port of call, thereby broadening the central Florida airmail and passenger service. Of course, the private flyer interests, which Orlando had promoted to a higher degree than elsewhere in the state, were an important consideration for airport enlargement.

By the summer of 1936, after Attorney Gray had nearly won his local battle, his ideas broadened about aviation to include the whole state of Florida. What had been accomplished in the city of Orlando could, by perseverance and cooperation, be made to extend throughout the state. This was the first deliberate attempt and work to popularize aviation within the state, which in less than two years was to thrust it far ahead of other states in making its citizens acutely air conscious.

During the summer of 1936, aviation enthusiasts from every part of the state

H. C. Whitney of Tallahassee is Florida's energetic two-fisted state aviation head.



Director Whitney (left) and G. Wayne Gray were snapped above during state air tour.

Under Maj. A. B. McMullen's direction, Florida led the nation in new airports.

were asked to attend a meeting in Orlando. In a simple, unpretentious manner the Florida Aviation Association was born. Quietly, effectively, this small but enthusiastic group, burning with ideas and plans, set about its work of making aviation popular in Florida. At the same time it resolved to make the state foremost of all states insofar as aviation was concerned.

From the very start they were beset with a major difficulty. Governor Cone, in his inaugural address, intimated that one of the first organizations to go into the discard would be the Aviation Division of the State Road Department, the backbone of Florida's aviation interests. But the governor either overlooked or ignored the fervor of the newly-formed group. They not only sold aviation with a capital A to the state road department, but today the state aviation director, H. C. Whitney, flies about Florida in a state airplane, while Governor Cone and others who opposed the aviation division are today active members of the Florida State Aviation Association, cooperating wholeheartedly in all of its programs.

Another barrier rose up against this newly-formed group—a 7c tax proposal on aviation gasoline. Through organization this proposal was killed in committee. Other minor skirmishes were engaged in and aviation began to grow increasingly important, if not popular, within the state.

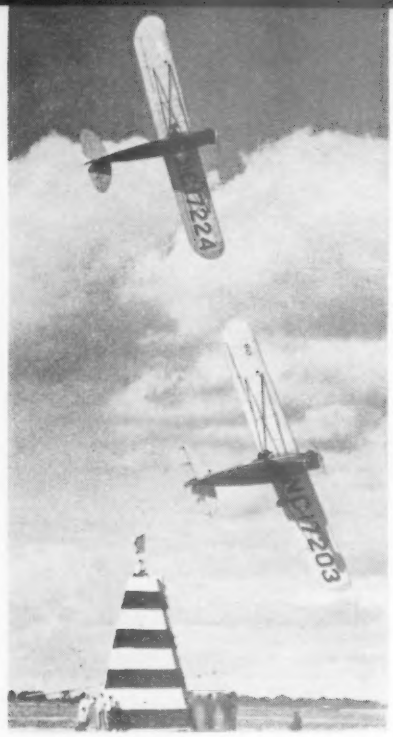
To find out how these problems were surmounted, it is necessary to look into the machinery of the Florida association. Incorporated under the state laws as a non-profit corporation, it provides the usual officers, but more important, a group of 67 directors—one for every county in the state. These directors are probably more responsible for the meteoric success of the association than from any other cause. The county directors really coordinate the state aviation interests into one smoothly functioning body. Through the county director plan, local control and interest are obtained which welds the "little fellows" in outlying communities to the bigger interests in the larger cities.

Then, of course, there are additional committees, some of them very strong and active. The more important of these are the technical advisory and the legislative committees. A distinct innovation to state aviation associations, the Technical Committee is made up of members who are prominent Federal and State Aviation officials. They *know* aviation and thus add a great deal of strength to the main association. The legal committee has a great many lawyer members who *know* the law and its ramifications, and all pulling together it is easy to understand why the success of this association has been so phenomenal.

Working with the various committees, officers and county directors, are a host of other interests, representing every phase of the aviation industry. Private flyers, the military interests who lately used Florida airports for important maneuvers, the commercial operators (fixed base and otherwise) and the two airlines within the state are thus brought within the fold of one common interest: to promote aviation and to make it popular, for it belongs to no particular sect, but to the public.

The Florida plan and setup has already proved its mettle in little more than two years; other state associations concede

These lightplanes are just a few of the hundreds that took part in the recent air tour to Miami. The little ships congregated in Florida from all parts of the nation.



These two lightplanes are competing in Miami's annual All-American Maneuvers.

that the Florida organization wields a power of influence as great if not greater than that of any other state association.

There are still difficulties to be overcome. The interests, common and technical, between the private flyer and the commercial interests must be more firmly cemented together. And then there is still somewhat of a provincial outlook, that of town against town in a rivalry that does neither good. But this irritation is being slowly ameliorated. The state organization, through the county directors and various committees have the two rivals meet together, and then each fight it out. The result is usually a common plan by which both may benefit. In this way various cities and towns reciprocate aviation activities by solving each other's problems.

The fame of the Florida organization, through these activities, has traveled far and wide. Mississippi and Tennessee now want to follow Florida's plan and setup. Other states too have signified interest and are asking for more information and assistance.

How does a state aviation association go about making its people air conscious? President Gray of the Florida Association explains it this way:

"The association stands first against any forms of taxation against the aviation industry in any of its phases so that our lusty child, aviation—and in particular private aviation—will be unhampered by official ties and harnesses, and that our airlines may survive and serve us not only as passenger and mail carriers, but in the matter of plants, shops and payrolls."

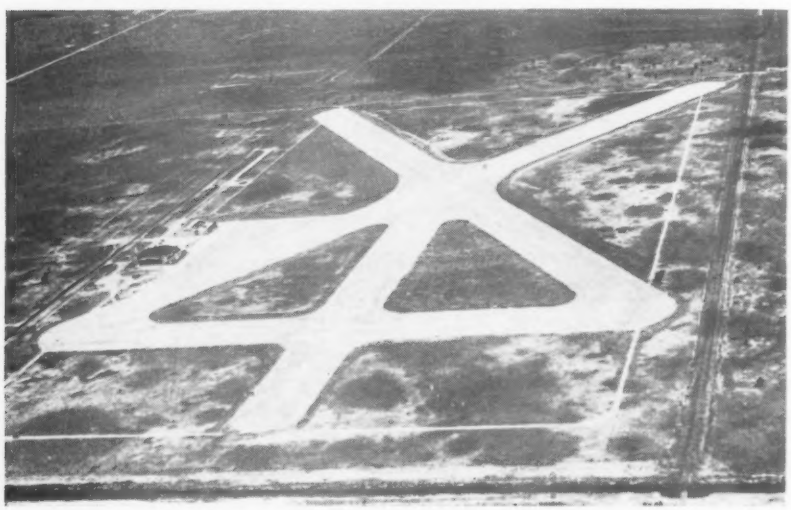
"But just how do you make your state more air conscious than any other state in the union?" he was asked.

"First, you must make aviation popular, and to do that you need a real live-wire organization with members that are *really* interested in aviation. Then comes a program of genuine help to all concerned. Sponsoring and assisting in air marking projects, further development of airports—especially in sections where they are needed to fill in the airway system gaps—fostering aviation-instruction classes in vocational and high schools, the establishment of aeronautical engineering courses at the state universities and the establishment of military air bases.

"This past summer we used a method that formerly brought us much publicity and a tremendous amount of enthusiasm, only we conducted it on a much larger scale. We held our second annual State Air Tour in which participated many of the well-known pilots and a great mass of the "little fellows"—the lads who make private aviation possible. There were many women pilots who accompanied us, adding color and romance. We stopped over at a great many cities

(*Continued on page 82*)

Miami Municipal airport probably is the busiest in the South. Annually, this field cares for 1,500 airplanes. Pan American operates from Dinner Key, south of Miami.



Flags Aloft

EVERY time an Imperial Airways flying boat takes off from Southampton with a load of passengers, mail and express, that ship always carries up to 52 different flags.

When POPULAR AVIATION requested further information on this unusual equipment, Imperial officials listed the flags and their uses. There is the Civil Air Ensign, the Royal Mail pennant (indicating that the airplane is carrying mail) and the flags of France, Italy, Portugal, Greece, Egypt, Union of South Africa, Siam, Persia, Iraq and Bahrein—all of them ports of call for the huge airliners. In addition, POPULAR AVIATION was informed, there are 36 international code flags, a pennant and three substitute flags carried.

The Civil Air Ensign and the Royal Mail pennant, together with the flag of the country in whose waters the flying boat has alighted, are flown above the hull during the time the ship is riding at its moorings.

Flags are not flown between sunset and sunrise, and the only other time when the Civil Air Ensign is used is when Imperial's flying boats pass each other 100 miles or more out of their last airport. This is a matter of courtesy whereby the flying boats salute each other.

The international code flags come into use when the flying boats are maneuvering amongst shipping on the surface of the water.

New Weems Course

BEGINNING early in October, under the direction of the Weems System of Navigation, of Annapolis, courses in air and marine navigation will be offered for the third successive year at the Hayden Planetarium of The American Museum of Natural History, New York, and the Fels Planetarium of The Franklin Institute, Philadelphia. Yacht owners, boating enthusiasts, flyers, amateur astronomers and all others interested will find these special courses a practical and theoretical education in the science of navigation. Cooperating with the two planetaria are New York University, Temple University and Drexel Institute of Technology.

In the last two years, scores of men and women attended the courses held in New York and Philadelphia. Re-creation of the appearance of the skies through the use of the Planetarium enabled the students to comprehend the principles of celestial navigation with great ease, and this year, too, several of the discussions will be held with the aid of the man-made skies.

Both dead reckoning and celestial navigation are to be covered, and each of these subjects will be divided so that the problems either of mariners or aviators will be discussed, and clarified, in accordance with the preference of individual students.

Clarence Chamberlin (inset) probably has flown more passengers in his big Condors than any other civilian pilot.

BARNSTORMING Goes Modern

by GEORGE R. REISS

Just because Jennies are gone doesn't mean barnstorming has. You'll be amazed.

INTRODUCING America's No. 1 "aviation salesman," Colonel Clarence D. Chamberlin, the man who needs no introduction, who probably has taken more passengers aloft than any other and who probably has "sold" more persons on flight than any other.

Introducing also Colonel Clarence D. Chamberlin's ancient ship, a huge, slow, lumbering, bulky ex-airliner, which probably has carried aloft more passengers than any other airplane in history.

Colonel Chamberlin, the trans-Atlantic flyer, is easily America's No. 1 "barnstormer;" he also is the operator of probably the largest barnstorming ships; and he is one of the few early trans-Atlantic pilots who has retained his fame down through the years.

While other "barnstormers" carry one, two to a half dozen passengers at a lick, Colonel Chamberlin packs 27 at a time into his huge two-motored Curtiss *Condor* biplane; while others count the day's work in dozens or scores of passengers, Chamberlin counts the day's work in the hundreds or thousands of passengers; and while other early air heroes have been forgotten, Chamberlin's name and fame are still fresh in everyone's mind.

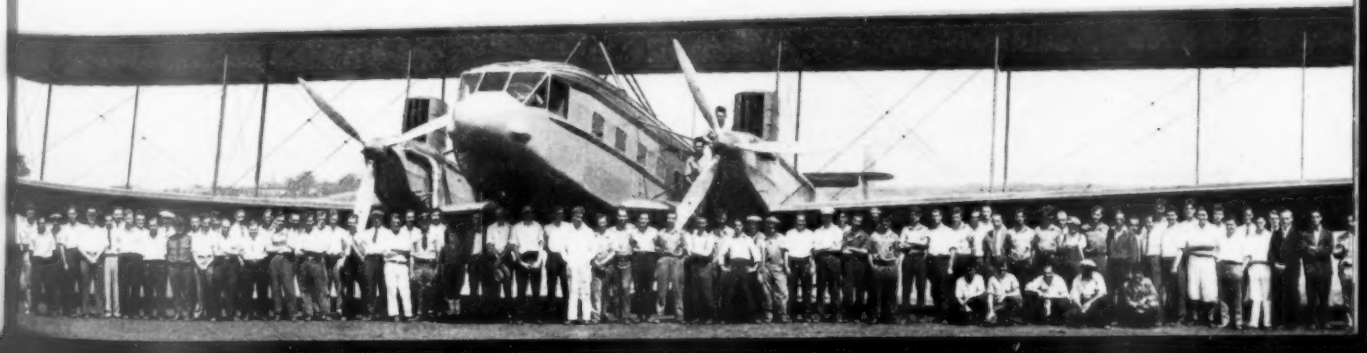
That's because Chamberlin has turned "aerial barnstorming" into big business, while yet retaining some of the tricks of showmanship, some of the dash and flavor of the old days.

Chamberlin, who gained international fame in 1927, only a few weeks after Charles A. Lindbergh flew to Paris, by flying Charles Levine to Germany in the famous old Bellanca *Columbia,* got his start in "barnstorming" in the airline business.

Chamberlin, a few years ago, was operating a little airline in the New England states. Needing flying equipment, he bought several big Curtiss *Condor* airliners, the first series, retired by Eastern Air Lines.

But with the big ship didn't come passengers to his airline and Chamberlin

As an airliner, the old Condor seated 20 persons. Chamberlin ripped out all the fixtures and added seven more seats. This ship is ideal for working small airports.



The old Curtiss Condor is a gosh-awful big ship, ideal for barnstorming purposes, and probably the only large airliner really ideal for that purpose. Reason: slowness.

sorely needed money to pay for the ships, to pay salaries and operating expenses. The days looked dark. Finally, in desperation, he advertised he would take up passengers at $1 each to acquaint them with the big ships. To his surprise, huge crowds flocked to the airport, waiting their turns to ride in long lines—and the $1 bills rolled in. Nor did the business end with darkness. In fact, it increased.

"How long," inquired the incredulous Chamberlin, "has this been going on? There's more money in this than in operating an airline."

Chamberlin promptly abandoned the line, flew the big ships to his shops (the old Fokker factory at Teterboro Airport, New Jersey, where he once built his Crescent monoplanes) and altered them for "barnstorming" on a mass production basis.

Now, the old *Condor* is a gosh-awful big ship, ideal for "barnstorming" purposes, and probably the only large airliners really ideal for the purpose. With a cabin nearly as big and nearly as high as a house, its 96-foot wings gave it an unbelievably quick take-off and slow landing speed, with huge loads—and also an unbelievably slow top speed. But it was ideal for working small airports, nearly as ideal as a *Cub*.

As an airliner, it seated 20 persons. But not enough. Chamberlin ripped out seats, partitions, washrooms, anything and everything that added unnecessary weight. And then he crowded in seats, 27 of them. Then he assembled a "barnstorming" crew and then started on the road that was to make him the nation's outstanding "barnstormer," making Ivan Gates and his flying circus look like pikers.

But the crew ran into hard luck—gobs of hard luck. For eight straight week-ends, they had bad weather which killed business. The ninth week-end produced perfect weather—but a big scheduled airliner had crashed, killing 17 persons, and that ruined business.

The crew hit a small Texas town, broke, the ships yet unpaid for, hotel bills staring them in the face, not enough gasoline left to get to the next town, and the suspicious Texans hostile to the New Yorkers.

"Murph," whispered Chamberlin to his head "barker," Leo Murphy, "We've got to get a load or two of passengers here, or we're sunk. We lose the ships and probably get in jail for beating our hotel bills."

Murphy went to work on the loud speaker system, advertising airplane rides, begging, cajoling, haranguing the prospective passengers—but none came forward to ride. But Murphy had one final trick up his sleeve. On the loud speaker system he introduced "Professor" Herbert Sherman, one of the pilots, who would conduct "personally conducted" tours of the big ships. He laid it on thick. And the price of the tour would be one dime!

The crowd quickly pressed forward, planking down dimes, piles of dimes, and the crew quickly took in plenty of money—enough to pay hotel bills, buy a few barrels of gasoline, and to eat heartily again.

From then on business usually was good, the big ships carrying 800 or 1,000 passengers a day each. But in another place, Chamberlin's crew again ran into difficulty. Again the passengers wouldn't ride, and Murphy felt confident if he could get one load of passengers, he could get plenty of business. But the passengers held back.

"Only $1 a ride," persuaded Murphy.

"Too much," commented a wag in the crowd.

"Okay," shot back Murphy, "We'll make it 10 cents."

The crowd pressed forward to call Murphy's bluff, quickly filling the ship with 10 cent riders.

Their dimes would hardly pay the cost of the gasoline to warm the engines—but Chamberlin had a trick up his sleeve. He taxied the ship up the runway, raced down the runway and took the ship off about 10 feet, then set it down again and returned to the loading platform.

"Did you enjoy the ride?" inquired Murphy solicitously, as the passengers disembarked. "A better ride for $1."

The crowd laughed long and loud at the joke; most of those in the ship promptly planked down $1 each, and others pressed forward to ride—and Chamberlin got thousands of passengers out of that town.

"That incident apparently changed our luck," said Chamberlin, "for we found plenty of business awaiting us nearly everywhere we went since then, in the three years we have been on the road."

Chamberlin's two big planes since have carried several hundred thousand passengers, probably making them the ships which have carried more persons than any others in existence. Incidentally, each ship has had about 8,000 hours in the air, having flown about 15 or 16 times as many miles as the average automobile is good for, and each still has a lot of miles in it.

In some cities, Chamberlin's two ships have taken aloft up to 2,000 persons each in a single day; and in some cities up to 10,000 to 20,000 passengers were taken up in a stay of a few days. But his average business is much less than that—about 1,500 passengers a week for the first six months of a year, and 2,000 to 3,000 a week for the last half of the year.

About 85 to 90 per cent of his passengers are "first riders"—folks who have never flown before—which makes Chamberlin a sort of "good will ambassador" of aviation. And a good half of his passengers fly at night, for he really specializes in night flying.

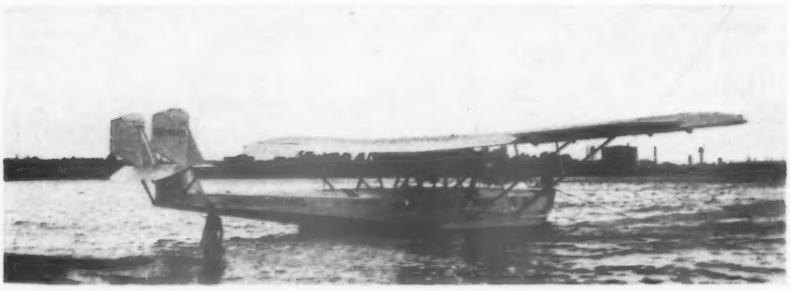
Colonel Chamberlin's prestige does him good stead, for his name ranks close to that of Lindbergh and frequently passengers remark:

"I wouldn't fly with anyone but Lindbergh or Chamberlin."

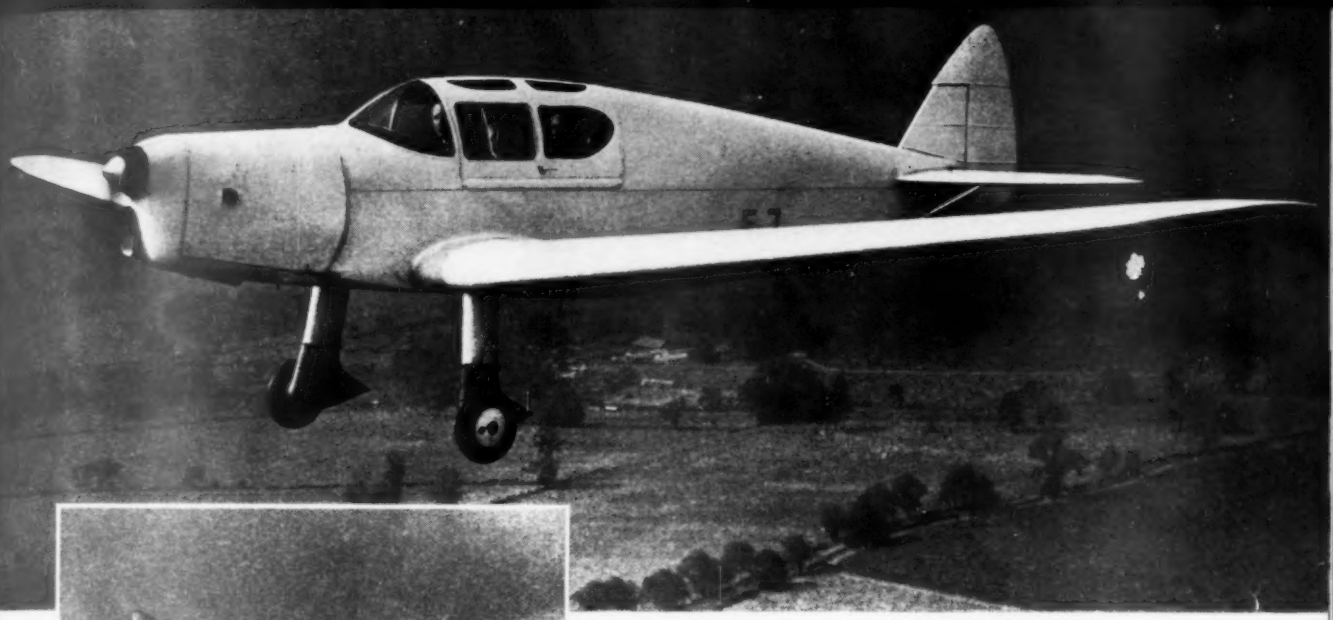
And once they have flown with Chamberlin, they become ready prospects for the airlines or charter service operators or flying schools.

Chamberlin's prestige helps him to get liberal newspaper publicity in the towns he visits and his fame for flying the Atlantic, his 20 years of flying expe-

(Continued on page 81)

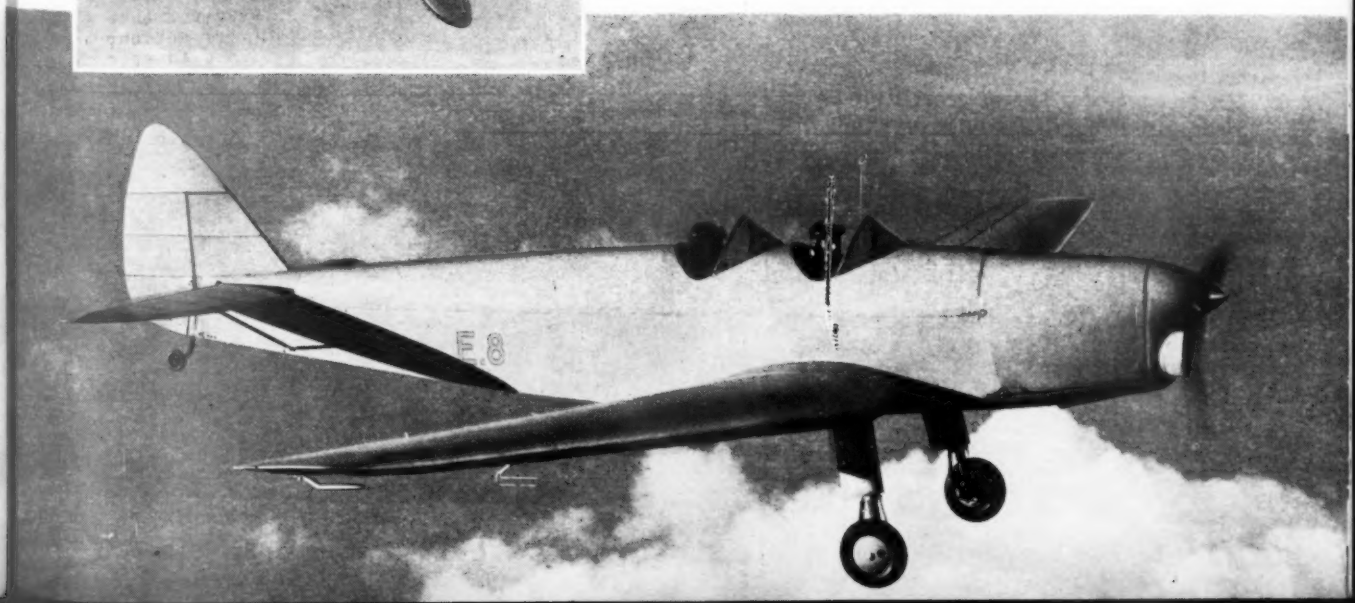


Chamberlin already is preparing for the day when his Condors will be useless to him economically. He recently purchased this big Consolidated Commodore flying boat.



LITTLE BRITONS

OVER in England the Air Ministry has some potent ideas concerning the training of air-minded youths who cannot afford either expensive training nor "big" airplanes. The airplanes on this page are just three of the rugged, yet highly economical lightplanes evolved for this extensive program. Members of the Civil Air Guard, as the new movement is called, will have access to these ships. At top and bottom of this page are the open and closed versions of the DeHavilland *Moth Minor*. The ship banking toward you at left is the new Tipsy monoplane. Powered with a 90 h.p. air-cooled inline *Gypsy Minor* engine, the *Moth Minor* is economically ideal for its mission. Economy is even effected with the ship's folding wings which reduce storage space to a minimum. Top speed of the cabin model is 115 m.p.h. Seats are in tandem. In addition, the ship is amply stressed for all aerobatics, despite its low horsepower. Whereas the cabin model is good for cross-country jaunts, the open *Moth Minor* is primarily a trainer. The Tipsy is an attractive little ship, powered with a 60 h.p. engine. Basically a Belgian design, the ship is being manufactured in England. A novel feature is its limited elevator control, designed to make landings safer. This, largely, for students.



FLYING

Assembling hundreds of farmers' queries in a sizeable scrapbook, Frank Bill flew them to Washington. He is shown above placing his baggage aboard Scoop IV for the return trip. The trip was a success.

Few American newspapers are as staunchly and continuously air-minded as the Bloomington (Ill.) Pantagraph. Here is the story of how that enterprising publication uses its airplanes for anything from photography to missionary work to Washington for its many farmer-readers.

NINE years of airplane news coverage and photography by *The Daily Pantagraph* of Bloomington, Illinois, have definitely proved that the aerial way is a distinct service, not an adventure—an asset, not a risk.

In all, there have been four planes—"Scoops I, II, III and IV"—beginning with an OX-5 Waco biplane. Scoop I was purchased in June, 1929, and was christened the following month at a "Central Illinois Air Derby" at the then 72-acre Bloomington airport.

With upward of 2,000 hours in the air and approximately 4,000 aerial photographs, *The Pantagraph's* airplanes have proved their news gathering value time after time. They have taken reporters and photographers over floods, over snowbound countrysides to train wrecks, fires, funerals of state, and on more peaceful rural photographic missions.

Latest, most imposing service of the *Pantagraph* airplane was its use in taking Frank Bill, farm editor, and Charles Driver, reporter-photographer, to Washington, D. C. Art Carnahan, who holds a transport rating, is the regular pilot.

Bloomington being in the heart of McLean county—accounted the third richest agricultural county in the nation—the implications of the AAA were all-important to *The Pantagraph* and its preponderance of farmer readers. Interpretations of the AAA were not altogether satisfactory. Mr. Bill, who is also the ace veteran aerial photographer for the publication, spent weeks visiting farmers of the newspaper's territory. He gathered hundreds of pertinent questions pertaining to the AAA. Assembling these queries in a sizeable scrapbook, off he went to the capital to lay them before Secretary of Agriculture Henry Wallace and other AAA officials.

The 700 mile hop was negotiated in Scoop IV, a Stinson *Reliant*, with only a stop at Columbus, Ohio, for refueling and luncheon, both ways. Ground and air cameras, portable typewriters and personal effects were in the baggage compartment. Leaving June 28, the three men returned to the present 164-acre Municipal airport June 30. Replies to the farmers' queries now are being published for the edification of all interested farmers.

Aside from the hundreds of "good will hops" in which municipal and other officials have been taken aloft in the four Scoops, there are many interesting insights on the value of the airplane. A. T. Anderson, prominent Pontiac, Ill., landowner, said after a significantly revealing flight, "I wouldn't dream of buying a farm without first viewing it from the air in order to see the layout, the thin spots, the drainage area, the missing corn hills."

J. B. Andrews of the University of Illinois agriculture college, discovered that the scope of Canada thistle invasion could be easily detected from the air, whereas it could be learned on the ground only by word of mouth.

"Crop reporters," said Farm Adviser J. H. Checkley of Logan county, after a countryside aerial tour, "should have airplanes. Then they could report more accurately."

In all this news flying, *Pantagraph* ships have never had a mishap. Nearest thing was in one of the old Waco biplanes when

Frank Bill, the Pantagraph's farm editor, is shown below discussing his newspaper's voluminous farm-problems scrapbook with Secretary of Agriculture Wallace (right).

SCOOPS

by W. ELDRED RICHARDSON

Scoop I was this old Waco "10" bought in June, 1930, the Pantagraph's first ship.

Left to right are Publisher Merwin, Charles Driver, Pilot Carnahan and Frank Bill.

Both farmers and aviation people are familiar with this sign on Scoop's fuselage.

Editor Bill's foot snagged a valve and dumped the gasoline supply. Pilot Carnahan glided to a perfect landing in a wheat field. Fuel was obtained from a farmer's tractor supply and the ship returned to its home port.

Safety is always stressed. There are regular inspections and adjustments, of course. The photographer directs the flight but the pilot has the authority to refuse to place the ship in unsafe positions—no matter what the proposed picture may be. An illustration of this was in connection with the opening of an Illinois river bridge at Pekin in Scoop II, a Waco powered with a Wright *Whirlwind* J-6 engine. Separate cockpits meant the use of manual signals from the photographer as to the desired picture positions.

The ship was headed south when the cameraman asked for a low position which would enable him not only to photograph the new bridge but the city's waterfront as well. The pilot refused because, as he explained afterward, the flight direction would have meant a plop in the river in case of engine trouble. Carnahan turned about, heading in the opposite direction and managed the desired 400 foot altitude—but ahead lay a smooth drainage district in which an emergency landing would have been possible.

Scoop III, a Stinson *Junior*, was nearly "scooped" on the Chicago stock yards fire. Bill and Carnahan had been to the city to get aerial shots of A Century of Progress. Though Scoop III had been delivered unequipped with radio, a set had been installed with a ball-weighted trailing aerial with which they amused themselves en route to Chicago.

After they left the Windy City the fire broke out—but they were indifferent to the radio and the aerial was neatly coiled inside the cabin. They heard none of the fire reports until they landed at Bloomington. The ship was hastily refueled and back they sped to get their pictures.

"Obviously," said Bill, "the altitude secured in a plane provides photographic scenes impossible from the ground. The airplane's speed and its ability to go cross-country without following congested highways make it far more speedy and dependable than automobile travel. The airplane has proved ideal, for instance, to present a picture of a corn husking contest where thousands of spectators and contestants are scattered over a wide area.

This photograph was taken by a Pantagraph plane and is of one of the Illinois farms photographed in that paper's highly popular contest.

Another Scoop identity contest picture was this one of Chatsworth, Ill. Pantagraph readers guessed it easily.

News coverage is an important function of the Pantagraph's Scoops. Below is an assignment covered—a tornado that nearly wiped out South Pekin, Ill., early this year.

"We were able to get a picture of all of Lake Bloomington on one film. Other views have shown the Alton railroad shops in their entirety; or the entire length of the McLean county centennial celebration parade—even though it covered a distance of 22 blocks.

"On many occasions, Scoop pictures have graphically depicted widespread flood conditions in different parts of Illinois—views that showed highways and railroads washed out, bridges missing, livestock standing or swimming to high points—views, in short, that would have been impossible from the ground, or from a boat, when the vital time element of newspaper publishing is considered."

Everyone in central Illinois knows the familiar orange and black Scoop. Approximately 1,200 pictures of outstanding farms have been published with rewards offered for their identification. More than 1,000 of these have been identified by owners who thereupon received framed and suitably inscribed original photographs. A good will gesture? Certainly, but also a service to the farmer showing him those glaring errors of land or layout that are not readily perceived from the ground.

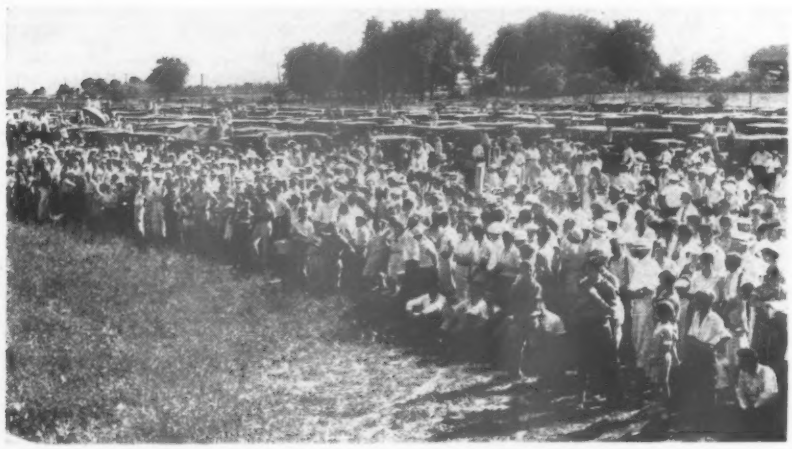
Bill's aerial experiences have led him into the field of target bombing. Harmless bombs, to be sure—copies "hot off the press" containing World Series or other extras. Bundles of newspapers, tightly wired in corrugated wrappings are methodically dropped off at 20 towns in Bloomington's area which would otherwise receive no detailed account of these events until the next day.

Here is the way the delivery log, as worked up by the circulation department and handed Bill, reads:

"Heyworth—west and south of high school, southwest of town, one block west of State Route 2. Clinton—east of town, in ball park. Weldon—southeast part of town, south of Illinois Central railroad, in pasture," and so on. Local agents are on hand to snatch up the "bombs"; break them open and deliver them.

In the winter of 1930, there was a serious train wreck at Forrest, nearly 50 miles from Bloomington by air and considerably farther by road—if the roads could have been used. There had been a blizzard the night before and all highways were effectually blocked by drifts. Open fields in most cases had been swept bare by the gale. On this chance, the flight was made. Even though a landing were impossible, air shots could be taken

(*Continued on page 78*)



Another example of Pantagraph air-mindedness is the annual Central Illinois Air Derby sponsored by the paper. Above is a typical crowd that attended a recent derby.

Know Your Markings?

THE following table will—we hope—put a stop to the hundreds of letters that come into these offices asking where such-and-such an airplane is from or what those big block letters on the fuselage and wings mean. With the exception of the United States, the commercial airplanes of the countries of the world are identified solely by a series of letters. Only letters used as international identification for American aircraft is "N". The following table gives a complete list of all international aircraft markings.

Example: CF-XYZ is a Canadian. PH-XYZ is from Holland; ZK-XYZ. New Zealand, etc.

CC	Chile
CF	Canada
CL or CM	Cuba
CN	Morocco
CP	Bolivia
CR	Portuguese colonies
CS	Portugal
CX	Uruguay
CZ	Monaco
D	Germany
EC	Spain
EI	Ireland
EL	Liberia
ES	Esthonia
EZ	Saar
F	France and colonies
G	Great Britain
HA	Hungary
HC	Ecuador
HB	Switzerland
HH	Haiti
HI	Dominican Republic
HJ	Columbia
HR	Honduran Republic
HS	Siam
I	Italy and colonies
J	Japan
LN	Norway
LZ	Bulgaria
N	United States of America
OB	Peru
OE	Austria
OH	Finland
OK	Czechoslovakia
OO	Belgium
OY	Denmark
PH	Holland
PJ	Curacao
PP	Brazil
PZ	Surinam (Netherlands West Indies)
PK	Netherlands East Indies
RV	Persia
RX	Panama
RY	Lithuania
SE	Sweden
SP	Poland
SU	Egypt
SX	Greece
TC	Turkey
TF	Iceland
TG	Guatamala
TI	Costa Rica
UL	Luxembourg
URSS	Russia
VH	Australia

(*Continued on page 89*)

INDIANA
STATE TEACHERS COLLEGE
LIBRARY

Above is Langley Field, main GHQ Air Force base and one of the Army Air Corps' most important air bases—and one of the easiest targets. Already, however, plans have been formulated and work begun on the moving of this base to Scott Field at Belleville, Ill.

The Future of OUR AIR FORCE

by JOHN C. A. WATKINS

This potent article is based largely on plans now being formulated, some of them already begun.

Continued from the October Issue

THE people of the United States have become more and more critical of a combination of two or three powers that, by their barbaric aggression, have marked themselves as international outlaws. Although we have been content to criticize without desiring to go to war, our criticism has rankled the outlaw nations and they, inspired by their successful aggression in other directions, are casting covetous eyes on this wealthy country. . . .

It is early in the morning of a fine June day, a few years from the present. You are sleeping peacefully in your beach cottage near industrial Baltimore, on the shores of the great Chesapeake Bay, when you become conscious of a deep drone. You stir uneasily, turn over, again relax. Suddenly, there is an ear-shattering crash! Then another, and another.

You leap out of bed and to the telephone. The line is dead—the concussion obviously has put it out of commission. You hurriedly slip on a dressing gown and run outdoors. There you huddle with the frightened family spending the summer in the adjoining cottage, and together you fearfully watch the reddened sky several miles away.

All along the Eastern seaboard, and out on the Pacific coast, huddled little groups of your fellow Americans are fearfully, helplessly duplicating that scene. In a few hours you will pick up the morning paper—provided there is a morning paper—and will read the story of the greatest catastrophe that will ever strike a civilized, peace-loving nation.

With a sinking, gone feeling, you read that those explosions, those ear-shattering concussions that put your telephone out of commission, were bombs hurtling down on the Glenn L. Martin aircraft factory, over where the skies are reddest. The factory is in ruins, you read. You learn from your paper that so is the United Aircraft plant at Hartford, Conn. On the Pacific coast, you read, smoke is rising from the shambles that once were the great Douglas and Boeing plants. You put the paper down, and wonder how long you will be alive.

And no one saw the airplanes that did this incredible, unbelievable damage.

That's the way most experts believe the next war will begin. It may sound pessimistic, but that's what they believe we should prepare ourselves for. There won't be any warning. Outlaw nations don't declare war any more—why give the other fellow a chance to prepare himself? Look what happened to the Chinese when they began to prepare.

The first indication that the United States was at war would come when the enemy dispatched huge fleets of bombers from across either or both oceans, timed to reach both coasts simultaneously.

Their first objective would be the aircraft factories because, with them in ruins, we would be delayed months, if we managed to hold out any length of time, before we could begin replacing the airplanes we would lose. And the worst part of it is that every aircraft factory manufacturing combat planes for the Army and the Navy is within easy reach of the coast.

The invaders' next step would be to raid the military fields, also within easy range of long-range bombers of the type we'll soon be seeing. They would destroy as many ships on the ground as

possible. Their objective, of course, would be to gain an overwhelming air majority, by destroying the factories building the airplanes, and blowing to pieces as many aircraft already built as they could find.

There isn't a major military field in the United States, most of them close to a coastline and with their ships sheltered in exposed, flimsy hangars, that wouldn't be easy prey to an enemy fleet attacking without warning.

Who would stop them? There would have been no chance for pursuit planes to be loaded with ammunition and light bombs, fueled and sent into the air. They would have bombed and gone before the Army and Navy knew that a war had started.

Even if our espionage system had forecast something of the sort, and in preparation for a possible raid we had placed sound detectors aboard small ships strung out in a chain a thousand miles off either coast, we would have no assurance that we would be warned in time. The raiders would fly at 30,000 feet or better, and with the engine silencers now in existence, there is grave doubt that the detectors would discover them.

But suppose we *did* have three hours' warning, which would be about the maximum if the raiders' engine and propeller throb were picked up a thousand miles at sea? A few of the enemy bombers might be knocked down as they approached their targets, but the overwhelming majority would get through.

It would be too difficult for pursuit planes to search an entire sky and pick out all of an enemy fleet approaching from God only knows how many different directions, and it would be an impossibility for every one of the raiders to be located and shot down.

No, even the Air Corps believes they would get through and bomb the fields and the aircraft factories—that is, some of the men in the Air Corps. Then, once this objective had been attained, the enemy would begin bombing steel mills, power plants and the factories manufacturing ordnance material. He would take his time, destroying these vital industries methodically and deliberately. He would have no opposition in the air for months, if at all.

He might never be able to land troops, because our Army and our Navy presumably would still be in shape for resistance, but why should he? He could bring us to our knees without landing a single soldeir on American soil. With our factories gone, our lights out and our transportation paralyzed, we would be forced to sue for peace at his own terms.

Our only faint hope, and that is a shadowy one indeed, would be to try and hold out for six months, building airplanes in widely scattered sections of the country, assembling them where we could. This would be a herculean task of doubtful success.

This picture should not be confused with the theory held by the Italian officer who believed that a nation could be brought quickly to its knees by airplanes conducting a campaign of frightfulness—bombing heavily populated centers and killing so many thousands that, in desperation, they would force a surrender.

Although no modern city has been subjected to such a campaign by modern bombers carrying heavy missiles and equipped with first-class bomb sights—Barcelona to the contrary—most authorities to whom I have talked consider such a policy a waste of bombs and airplanes.

They feel that the morale of the people of the invaded country would be of lesser importance than other considerations. No matter how fervent they were, no matter how thoroughly aroused they might be to the necessity of defending their country, they would be completely stalemated if the industries and equipment vital to such a defense were destroyed.

"How d'ya turn on the dome light?"

They believe that civilians who will be killed in bombing raids on American cities will die because they are near a power plant, a factory or a railroad junction which the enemy has decided to blast—not because the enemy believes that a campaign of frightfulness will shatter the defenders' morale.

What can be done to prevent such a catastrophe, a disaster that experienced men—not Sunday supplement alarmists—feel is entirely possible?

The problem is divided into two parts. The first is the prevention of attack by having the facilities to strike at the roots of the invader's plans. The second concerns itself purely with defensive measures.

We must foster the development of long-range bombers and other types of fighting craft—much more so than we are doing now—by subsidizing the experimentation, particularly on big ships, and buying several of each promising model so that we may always have a reasonable working number of each type on hand.

These airplanes would have to be based in small numbers on many more airdromes than we now have available. More big fields would have to be built in remote sections of the country, far away from the coasts and equipped with underground, bomb-proof hangars and barracks. Smaller emergency fields, resembling from the air ordinary cow pastures and meadows, should be strung along the coasts and the two land borders, ready for immediate occupation.

This is because it is no longer necessary for bombers to be based permanently ,at such fields as Langley which is located in Virginia uncomfortably close to the Atlantic coast. With the range now available, the bombers could be located far inland, between the sea and a cordon of defensive weapons, and still have the speed and endurance to reach the coast in time after the alarm had been sounded.

The second point in the prevention program would be to build as many factories capable of constructing big airplanes as would be efficient, in isolated spots scattered well away from each other and from the coasts, and fairly safe because of their inaccessibility.

The third phase, which may sound a little fantastic at first thought, but which is considered seriously by many authorities, would be the construction of a completely bomb-proof, gas-proof, government-maintained emergency factory, far in the interior of the United States. There sets of drawings of each new ship would be sent. There duplicate jigs and dies for each current airplane would be kept, ready for the declaration of war.

Immediately upon the "declaration," and by that I mean the opening of hostilities, thousands of trained workmen—those who hadn't been killed—whose own factories inevitably would have been destroyed in the first early morning raids, would move into this bomb-proof plant which, of necessity, would be self-sustaining, start the wheels turning and begin the production of the aircraft which the material division of the air force decided should be built.

From the purely defensive standpoint, there are two major programs to be accomplished. The first is to improve our anti-aircraft and our pursuit planes, both having the same ultimate purpose. The second is to find some adequate means of providing some protection for our vital industries in the interval between the time the enemy attacks and the home

(*Continued on page 72*)

MILITARY MERRY-GO-ROUNDS

THESE six Kellett YG-1B Army Air Corps autogiros have become the center of much controversy over the value of that aircraft as war material. But the autogiro won a major victory not long ago with the delivery of the six ships shown flying in formation near their home base, Patterson Field, Ohio. The Army's permanent autogiro detail will take part in various tests to determine their value as observation ships and artillery spotters. The YG-1B's are powered with 225 h.p. Jacobs engines.

SANTA PAULA'S FLYING FARMERS

by RODNEY B. RADFORD
Photographs by the author

We had been looking for "the most air-minded American city" for some time. One airplane for every 180 persons is Santa Paula's claim to fame.

Bill Hackbarth manages Santa Paula's airport.

The author.

WHEN a farmer flies, that's news. But when 13 farmers get together, build their own airport and hangars and fly their own planes a quarter of a million miles in eight years without a major mishap, that's, well, it's the record of the boys at the airport of the nation's most air-minded city.

Santa Paula, California, with a population of 7,200, has a total registration of between 35 and 40 planes, more per capita than any other community in the nation.

To many of you living in large cities with your aircraft factories and giant airline terminals with paved runways as long as our "Main Street" and the last word in beams and lighting equipment, this may seem to be much ado about nothing, but remember—the air-mindedness of a community is not judged by the number of twin-motored wakes passing overhead. We are talking of a typical American town, a little town that has taken to aviation in a big way.

Not all of the planes registered are now at the port but to 16 modern cabin ships Santa Paula is home, though they are seldom all together when the last hangar door is closed at night.

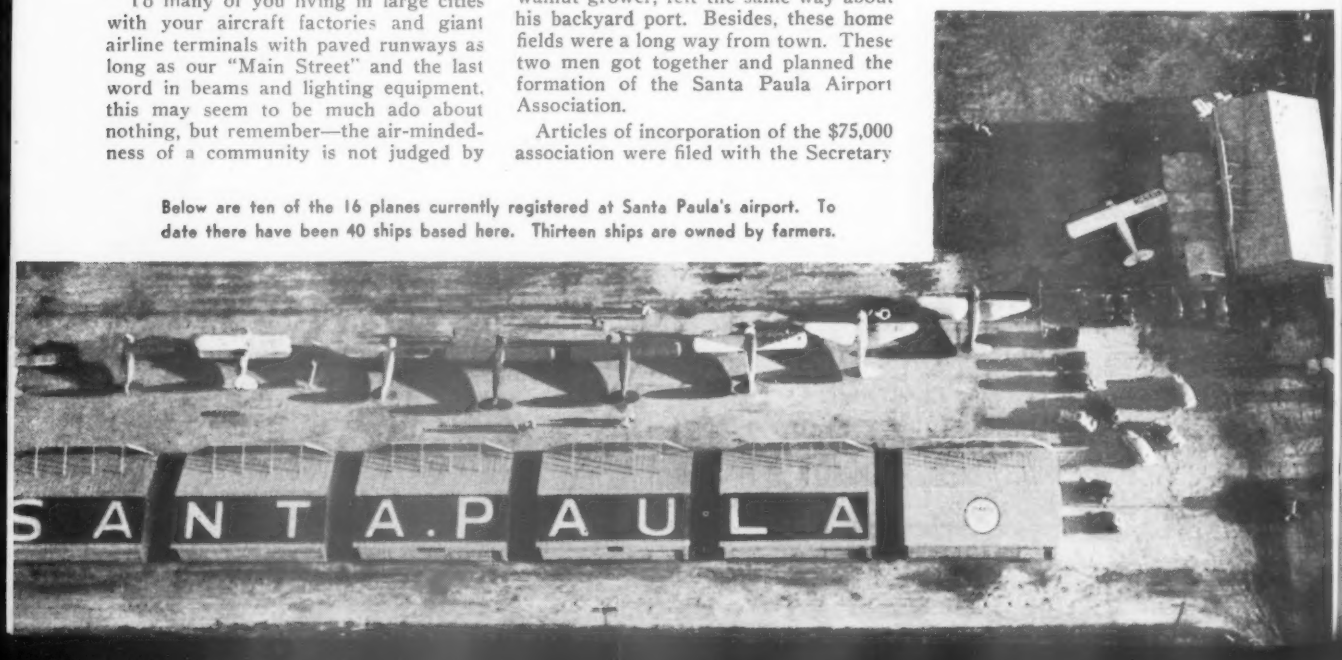
Thirteen of the planes are owned and flown not by commuting stock brokers but by farmers—farmers who have rolled them to a stop on the runways of nearly 200 major airports of the United States and Canada.

It all began only a little more than eight years ago when Ralph Dickenson, a Santa Paula citrus grower, decided that his backyard was a bit cramped for a good landing field. State Aseemblyman Dan W. Emmett, also a citrus and walnut grower, felt the same way about his backyard port. Besides, these home fields were a long way from town. These two men got together and planned the formation of the Santa Paula Airport Association.

Articles of incorporation of the $75,000 association were filed with the Secretary of State in April of 1930 with Ralph Dickenson named as president, Victor Cummings as secretary and Milton M. Teague as one of the directors. Since that time others have been added to the list—21 in all—including Guy L. Hardison, H. C. Sharp, Paul Young and LaVerne Hopkins, who contributed from $1,000 to $4,000 each and a lot of enthusiasm to the construction of eight metal hangars and the 1,750-foot runway.

When the airport was officially dedicated in August of the same year Santa Paula held its biggest celebration which was attended by famous aviators from all parts of the country. Among them were Roscoe Turner and Art Goebel who, together with the assembled crowd of spectators, acclaimed the men who had made the airport a reality.

From that time on flying went ahead by leaps and bounds. Planes from Santa



Below are ten of the 16 planes currently registered at Santa Paula's airport. To date there have been 40 ships based here. Thirteen ships are owned by farmers.

Polishing up his expensive new Stinson is H. C. Sharp, widely-known California citrus and walnut grower. Not an outright luxury, the ship helps Mr. Sharp in business.

Marie Cochran, popular Santa Paula flyer, dons a parachute with Bill Hackbarth's aid.

Paula have been seen at airports from Burbank to Newark and from Mexico to Canada. Ralph Dickenson has made several round trips to New York and recently on a nation-girdling hop he flew from Santa Paula north into Canada, east to Connecticut, south to Tennessee and west to the Pacific Coast again. He is now in preparation for a trip to New Orleans.

Dan Emmett, who has made six round trips from Santa Paula to New York recently made a round-the-world pleasure trip. How did he travel? By air. At this moment Charles Jarrett of Santa Paula is making a 20,000 mile Clipper trip around South America. Guy L. Hardison, a pioneer citrus grower and oil man of this area, bought his plane for the purpose of making geological surveys of oil properties which he feels can be viewed to best advantage from the air. He also makes pleasure trips to spots as far from home as Wyoming.

Don Henderson and Paul Young, citrus and deciduous fruit growers, use their ships for business and pleasure. At almost anytime planes are leaving on a caravan trip to the trout streams of the high Sierras, the dedication of a bridge, opening of a rodeo or just to the desert for a day of rabbit hunting. In fact, it doesn't make much difference what the occasion if they can fly to get there.

Still, with all these big gas bills and the unusual interest in air travel, air shows are noticeably absent at this airport. The directors of the association feel that there is no place for spectacular "lucky" flights in their scheme of things. Anyway, there is plenty of interest and it doesn't take a delayed parachute jump or an upside down flight over the hangars to stir it up.

In a way, this interest is quite natural as there are things here for flyers to do and places to go in the usual California weather. The airport is a center of aerial activity for this region partly because of its location.

It is just 30 minutes by plane to Los Angeles, five minutes from the beach, one hour from good trout fishing country, and only 20 minutes from ordinarily inaccessible mountain locations where deer are plentiful. As this article is in preparation three planes are being made ready for a trip to a high, secluded mountain meadow where there will be excellent hunting far from the roughest spot that can be reached by automobile. A trip that once took two tiresome days by pack train now is covered in less than 20 minutes.

When Santa Paula flyers tire of such sport there are always the Channel Islands to be explored, where smooth hard-packed beaches are natural landing fields. Climbing to 6,000 feet for safety over the open water, plane-loads of 1939-model adventurers have dropped in at Santa Cruz, Santa Rosa, Anacapa or San Miguel Islands in a manner far different from that used by Cabrillo who first discovered the group. Here they find good ocean fishing around the kelp beds in island coves and the dangerous sport of boar hunting in rocky canyons. All this is within a few minutes of home.

This community's interest in things aeronautical is not confined to farmers, their sons and local business men. Marie Cochran, one of the port's most enthusi-

Seven of Santa Paula's present 16 airplanes are shown here on the line for inspection. The field is 30 minutes from Los Angeles by air, one hour from trout fishing.

astic boosters, gets right in and takes on a man's job of polishing up the wing lights in preparation for one of the popular moonlight night flights.

Girls are taking lessons in both flying and construction. One Santa Paula aviatrix, Miss Edith Bond, became quite famous throughout Southern California for her flying ability.

In the past year alone, passengers and students have made 3,500 flights and 10 local students have soloed. When one enthusiastic student purchased the plane that had been the most popular trainer, ten other students immediately signed up for enough instruction time to make possible the purchase of a new ship.

Counting the present students and all who have learned to fly in the past years, the community can boast of about 40 pilots. Before you say this grand total will not add greatly to the national figure, let me remind you again of the size of this community. If every town were as far along it would be a great day for aviation.

Since the project first began and with all of the thousands of flying hours Santa Paulans have marked up there have been only three crack-ups and none of a serious nature among the original group of farmer-pilots. In regard to this Ralph Dickenson said:

". . . Flying is the world's finest means of transportation and not a pastime for thrill seekers. Stunting for the fun of it is strictly taboo."

To carry on these ideals in developing the wings of her student flyers, Santa Paula has chosen J. W. "Bill" Hackbarth to manage the airport and keep a close check on its activities. Bill first took to flying in a most unusual manner. It was in Rocksprings, Wyoming, in 1921. Bill had been studying aviation and putting in his spare time building his own ship. After months of work the day for the "test flight" was at hand but there was no test pilot, for no one knew how to fly the "Hackbarth Special"—including Bill himself, who had never had anything but self-instruction in theory and had been in the air as a passenger only once.

A large crowd had inspected the finished ship and left the field disappointed not to have seen it in flight. Bill decided to taxi up and down to get the feel of the controls. Taxying up the field was uneventful, but coming back was a different story. The ship picked up speed and, aided by a wind, was in the air before he could say . . . "I knew I never should have gotten in the thing". Making a wide, cautious circle in preparation for a landing, Bill could see every car in town heading for the field as he aimed her nose at the runway and cut the throttle. He had miscalculated and gave the field a wide berth. With a pull on the stick and a roar that electrified the gaping spectators he was again heading skyward. "After making a couple more passes at it I got all three points down together and as neatly as I have ever done it since." An ambulance that had been sent to the field by a friend had to go back without him.

(*Continued on page* 87)

The New Cub Coupe

The new Coupe retains its Cub appearance.

WITH the demand for the chummier arrangement of side-by-side seating, the Piper Aircraft Corporation has followed the lead of Aeronca and Taylorcraft by designing and producing the *Cub Coupe* shown above. Although the Piper company gave POPULAR AVIATION no performance figures with which to compare the *Coupe* to its competitors, they do point out that their new ship's performance is as good if not a little better than its 50 h.p. tandem job. Standard engine on the *Coupe*, incidentally, is the Continental A-50.

The *Cub Coupe* is in that newest airplane class: "de luxe luxury lightplane". Structurally, the new ship follows conventional design, being an externally-braced monoplane with the standard *Cub* wing section. This model, however, comes complete with brakes, oleo struts, wheel pants, compass, air speed indicator and strut fairings—all as standard equipment. The Piper company has made a definite effort to beautify its latest product and, as the photograph illustrates, have done a fairly commendable job. Special effects worked into the engine cowl and the tail assembly have given the new ship a rakish appearance.

Careful, Seaplane Pilots!

DEPTH perception (judgment of distance and height) over water is practically impossible to achieve, the Aero Insurance Underwriters point out. Approximately 50 pilots and passengers have lost their lives, the insurance firm warns, because of glassy water. Aero Insurance Underwriters experts, then, have the following pointers to offer:

"The best method for making landings under conditions of glassy water is through a power stall. This can be done because glassy water lends itself to flying speeds above the stall without danger of 'stubbing your toes'. It is the best method used for making night landings on water. The technique is to glide down to a 'safe' altitude in a normal way. A safe altitude would probably be something like 50 or more feet so that the airplane is well cleared of the water at this point, the throttle is opened somewhat and the nose pulled up so that the ship is slowly losing altitude with an air speed of something like 20 m.p.h. above the stall If the settling feels too fast, a little more power is applied. This operation is followed until the ship touches the water. This recommendation also applies to water landings in very thick weather."

Glassy water not only makes seaplane landings difficult but also, when it adjoins airports, adds to the troubles of landplane operations. A pilot experienced in both seaplane and landplane operations writes as follows:

"I would urge that careful consideration be given to the desirability of advising against the location of airports on islands or the equivalent. On several occasions in my experience as a private flier I have found such fields very difficult to get into. On a dark day, such as with heavy overcast, when there is no wind, the water is dark and glassy. I have had great difficulty in finding the water with a seaplane. Under the same conditions, a landplane's approach to an airport surrounded by water is made very difficult because of the pilot's inability to get his depth until he is actually over the field, after which he may not be able to adjust for too great an error in depth, with the result that the approach has to be repeated. Add to this condition a low ceiling with poor visibility, a pilot already in a state of anxiety from having battled bad weather, and he is in no condition to be depended upon to repeat his approach safely."

Suggestion: Mark the runways with transverse stripes of a color contrasting with the runway. This will help depth perception because the "ladder effect" changes with height.

OUT at **Selfridge Field** recently a P-35 and a P-36 were lined up together . . . you know the ships . . . the P-35 is the **Seversky** fighter, and the P-36 is the **Curtiss** . . . the P-35 has a 950 h.p. *Twin Row Wasp B,* while the P-36 is equipped with a 1,200 h.p. *Twin Row Wasp C* . . . both ships have constant-speed props . . . two of the best pilots in the **First Pursuit Group** were chosen to fly the two airplanes, and the two airmen then proceeded to put on a demonstration to see how the two ships stack up against each other . . . the story goes that the ensuing "fight" was one of the hottest sessions those hardened pilots had seen for many a day . . . they finally agreed that the P-36 had the edge over the P-35, but largely because of its extra 250 h.p.

* * *

There's lots of **Seversky** news this issue: From the Long Island plant of the company comes word that the next **Seversky** fighter will weigh nearly 7,000 pounds and be powered with a *Twin Row Cyclone* giving 1,600 h.p. at takeoff . . . they already have the engine at the plant and the plane is nearly ready for tests . . . the prototype for this fighter was seen—only for a flashing second as it streaked past—at the St. Louis Aerobatics Competition last year . . . the landing gear pulls into wells in the under surface of the wing so that there are no bulges as in the P-35 . . . all this adds up to more speed . . . they say about 360 is expected.

* * *

We've run into reports that **Cessna** is building a twin-engined plane for the private owner . . . and that **Warner** is planning to add about 20 more horsepower to the rating of its *Super-Scarab* engine now rated at 145 h.p. . . . the story we heard was that **Cessna** was to use two of the newest *Super-Super Scarabs* in their airplane . . . the plane is beyond the paper stage . . . and the engine rating is expected to be granted soon.

* * *

Interesting sidelight No. 9365572K: **United Air Lines'** behavior in connection with that recent 12-page spread in LIFE . . . though an excellent bit of propaganda for air travel in general, LIFE's coverage particularly gave **United** (whose airline that magazine featured exclusively) so much of a thrill that that airline had a few minor but pleasant convulsions . . . one tasty morsel was mimeographed out to all **United** employes by its breathless press agents:

"As in the reporting and editing of all major stories of this nature, there is the chance that a trivial error or so may be made, with no bearing on the importance and accuracy of the story as a whole. *We ask your cooperation in refraining from writing letters to the editors of* LIFE *pointing out such possible errors or in other ways criticizing the story.* (The italics are the press agent's.—Ed.) It is our desire that LIFE MAGAZINE should in no way feel that our company or any individual employe thereof is unappreciative of the constructive job being done for air transportation in general. Should individuals in our company write critical letters, such letters might be construed as indicating lack of appreciation on our part . . ."

Hmph!

* * *

A little item from Europe tells how **Col. Charles A. Lindbergh** smacked a **Russian** snooper down in Moscow recently . . . the way we got it is that **Lindy** was going about his business in the Russian capital one day during his latest visit there when he noticed that someone was trailing him wherever he went . . . so, at one street corner, **Lindy** stopped and waited for the human bloodhound . . . when that individual arrived he ran right into a stiff American arm with a fist on the end of it . . .

* * *

Speaking of **Lindbergh,** we also hear that he's seriously at work on the development end of an important international airline . . . most logically, between Russia and the United States over the top of the world . . . we do know **Lindy's** been conferring quite extensively with **Prof. Otto Schmitt,** the famed Russian scientist who flew up to the **North Pole** and established a base.

* * *

Incidentally, we won't be very much surprised at all if the **Lindberghs** return to the United States to establish their home . . . it may not be for a year or two—but it *will* be . . .

* * *

From time to time we've gotten wind of a batch of warplanes being built for the **Chinese** or **Japanese** by an American manufacturer . . . but when that manufacturer discovers that we know of the order and intend making mention of it in this column, he invariably tries every bit of subterfuge in his power to steer us away from the story . . . which, in turn, makes us all the more curious . . . mainly because there is no law that forbids the selling of military aircraft to either China or Japan . . . yet why does one manufacturer on the east coast, for instance, insist that the batch of modern two-place warplanes being exported to the Orient are "for Siam" . . . when we personally know a good half-dozen of that manufacturer's own employes who never have made any bones about the fact that the planes are going to Japan . . . that's a funny thing about American manufacturers . . . they deliberately surround themselves with such a cloak of pseudo-mystery that they practically force us to find out what the dickens all the secrecy is about . . . when there would have been a comparatively insignificant item involved had they laid their cards on the table at first.

* * *

This brings us to the stories of fast fighting airplanes that are seeping into the U. S. from both east and west . . . remember in an issue a couple months ago we mentioned that **Frank Sinclair,** Seversky's boyish engineer-test pilot was in the Orient . . . he's back now with some of the most wonderful stories about **Japanese** and **Russian** fighting planes—and he should know because he's one of the best pilots of fighters in this country as he proved when he wrapped one of Alex Seversky's P-35s around the 10-mile course in the Thompson Trophy gallup of 1937.

Frank says that the U. S. has wonderful airplanes but that our fighters won't do some of the things that the **Japanese** and **Russian** ships will . . . for instance, he says, the **Japanese** have a light single-seater with a 1,000 h.p. motor that will run rings around anything in this country . . . the plane has a big engine, very small gasoline tanks, its guns and a limited supply of ammunition and little else aboard . . . not like U. S. Army and Navy fighters on which "everything but the kitchen sink" is included.

The Japs, he says, fly up to the front on a belly fuel tank . . . in the combat zone they drop this tank and fly on their main tank that holds enough fuel for about two hours . . . with this tank exhausted they switch to their reserve and skedaddle for home, arriving usually, with the needle showing zero . . . the fighter they fly weighs 3,700 pounds as compared with the U. S. Army fighters weighing almost 6,000 pounds . . . they have no controllable pitch propellers, mixture controls, radio, blind flying instruments, etc. . . . when they get in a fight they simply fly the plane and operate their guns.

The Jap plane can turn inside the American ships because it's lighter, and consequently the mass that must change direction in turns is less. Frank says the **Russian** fighter he saw in China was similar to the **Japanese** pursuiter . . . the **Russians** had retractable landing gear but nothing else that was complicated . . . lightness, strength and simplicity are the watchwords of the good fighting airplane designers . . . they leave long range, bad-weather flying to the bombers that can carry instruments, enormous tanks of fuel, and radio.

* * *

All sorts of last-minute chatter: we hear that both **North American** and **Lockheed** are working on high-powered fighters for the **Army** . . . and that **Lockheed** is building a "12" with tricycle landing gear for the **Navy** . . . and that **Douglas** is working on a twin-engined attack-bomber, also for the **Army** . . . keep your eyes and ears peeled for another trans-Atlantic flight . . . this one with an American twin-engined flying boat . . . probably to Holland. . . .

END

Plucky Jacqueline Cochran is congratulated by Ray Brown (left) and Alex Seversky on winning the Bendix.

S. J. Hungerford, Trans-Canada Airways official, recently introduced new pilot and stewardess uniforms.

Personalities

Actor Victor Jory (above) is shown at the controls of a Hollywood mockup of a PBY-1 in Warner Brothers' forthcoming "Wings of the Navy".

John Thomas Smith, Jr. (left) has one of the world's oddest jobs. His shadow shields pilots' eyes from Kansas City airport's floodlights.

Al Menasco recently resigned from the famed engine company bearing his name.

To Arthur H. Marks goes credit for putting the U. S. in the helium business in 1918.

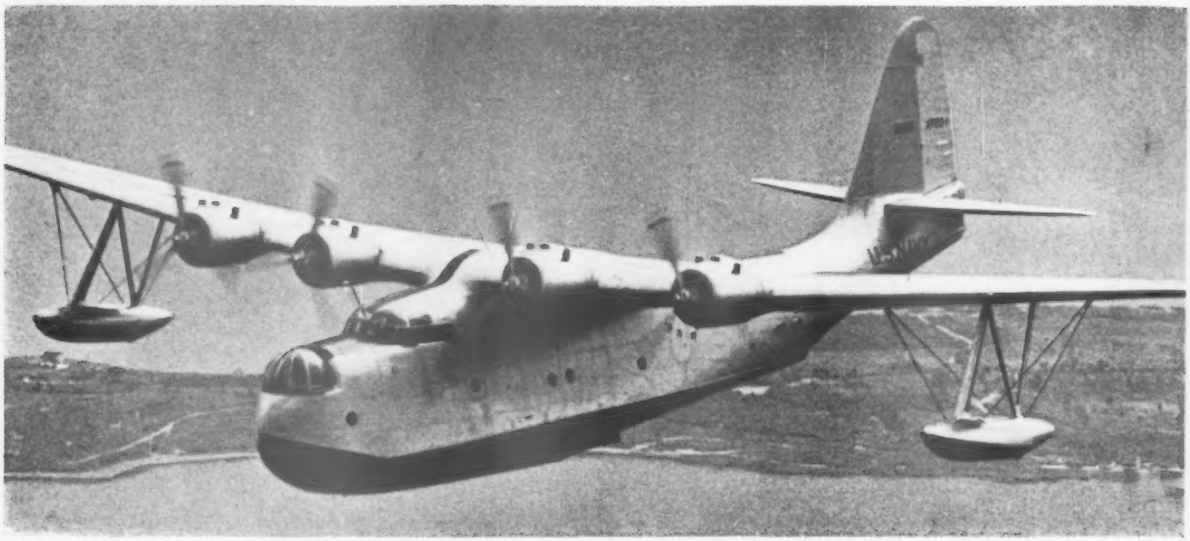
C. C. Brayton won most prizes in First Western Lightplane meet held in California.

Lawrence Youngberg is going blind, wanted to see Texas. Braniff Airways flew him there and back free.

This candid photograph is of Illinois Governor Henry Horner who is air-minded, flies often. He had just flown with the National Guard.

Leroy Latimer tests airplane tires, has made 18,000 "test hops" without leaving the ground.

Bernarr Macfadden, though 70, loves flying. He bought this Northrop, entered it in the Bendix Trophy Race but cracked up during practice.



The giant Sikorsky XPBS-1 is at least a warning of what a future war holds in store for the admirals.

FLYING BATTLESHIPS

by KURT RAND

Will the airplane ever replace the battleship? There are those who believe it is possible.

ENEMY beware!

Uncle Sam is going in for winged battleships, with a destructive power as great as, perhaps greater than, any known existing airplane!

The Army has its sensational four-motored "flying fortresses".

Now, after three years of secret experimentation, the Navy reveals that it is ready to organize squadrons of "air battleships", 25-ton leviathans that could machine-gun into annihilation large numbers of enemy planes, while bombing and torpedoing into impotency invading warships below.

Closely guarded today lest foreign agents obtain the clues to their great destructive strength and their phenomenal performance characteristics are the Navy's two experimental dreadnaughts of the sky, forerunners of dozens of similar airboats which will make certain for the United States domination of all the seas within the scope of the mainland and its "lifeline" territorial possessions.

One is on the east coast—Sikorsky's great four-engined bomber, designated as XPBS-1 when it was accepted by the Navy as an experimental plane late last year.

The other is on the west coast—Consolidated's giant seaplane XPB2Y-1, which only recently was finally declared acceptable by a Navy Trial Board.

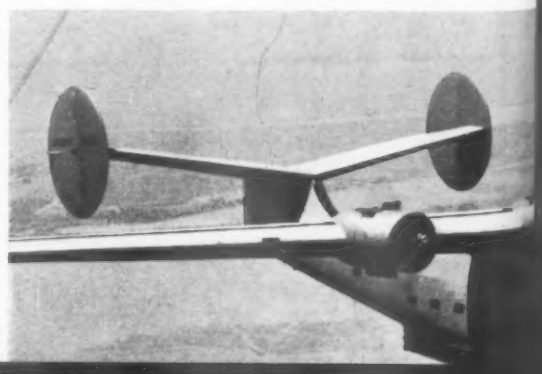
Into each have gone hundreds of thousands of man hours of engineering and shop labor; endless detail drawings were required of each vital part of the huge planes; the mockups alone—wood-and-fabric full scale replicas of the finished job—required six months and more to build. Mistakes were made, and costly delays resulted. The requirements of ruggedness—the ability to take terrific punishment from heavy seas as well as from enemy bullets and shells—and the further need for safety and efficiency proved a challenge to America's best talent in aircraft engineering and designing. It was a challenge successfully hurdled.

And today the United States Navy proclaims to the world that it has a lethal weapon which can cut an attacker to bits hundreds, yes thousands, of miles from American soil only a few hours after the first alarm is spread.

With Consolidated's bomber accepted, the Bureau of Aeronautics will compare performance data of the two experimental airboats, awarding a production contract to the company whose plane

(*Continued on page* 80)

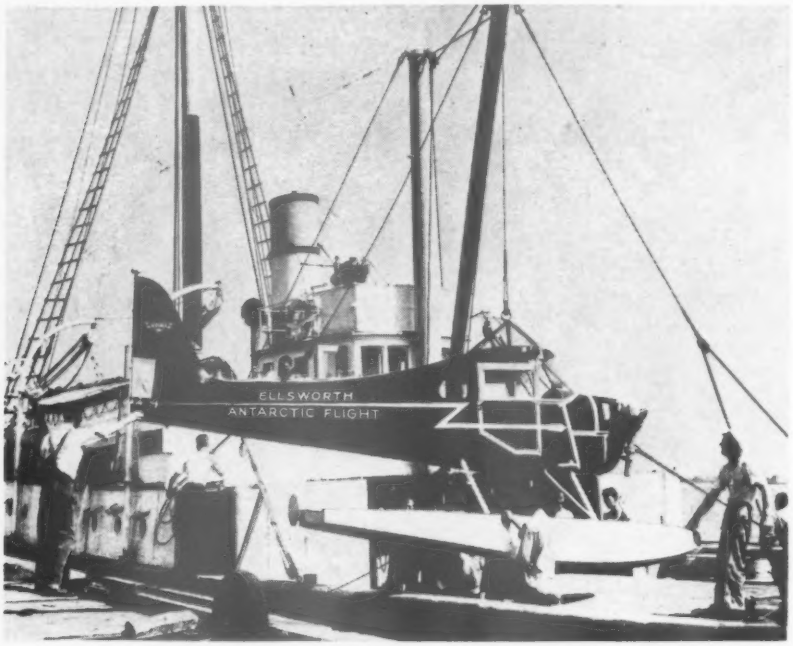
Consolidated's flying battleship got the three tails above and below. The two above failed; that below has been accepted.



FLYING BATTLESHIP

Consolidated's mammoth four-engined XPB2Y-1 is just one example of what an enemy fleet will have to contend with.

A Lightplane to the Antarctic!



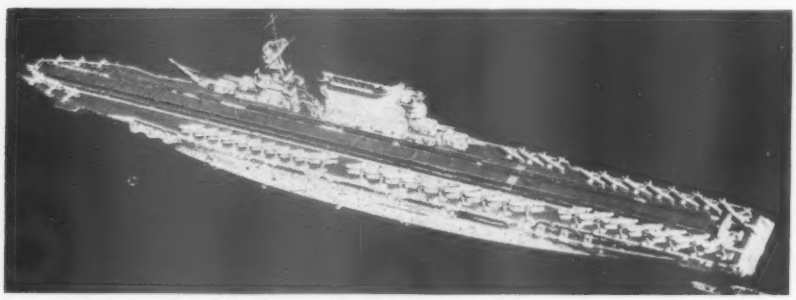
Lincoln Ellsworth's Aeronca going aboard the Wyatt Earp.

IT'S definitely news when a famous explorer accepts a comparatively tiny lightplane to take along on his latest trip to the Antarctic. The explorer is Lincoln Ellsworth and the lightplane he's taking along is the little Aeronca *Sea Scout* shown being loaded aboard the expedition's base ship in the above photograph. The Lincoln Ellsworth Antarctic Expedition also is taking along a Northrop cabin monoplane for long-range flights over Enderbyland, a vast uncharted region covering 750,000 square miles in the Antarctic near the South Pole.

According to the Aeronca people, the little plane was delivered to W. K. Vanderbilt, millionaire New York sportsman flyer. Mr. Vanderbilt apparently has loaned the ship to the Ellsworth expedition. The ship has been corrosion-proofed throughout and is equipped with two doors, navigation lights, special compass, clock and cabin heater. It is equipped for land, sea or ski flying. The Antarctic expedition will use the Aeronca as a means of communication.

How Sharp-Eyed Are You?

IF it's so easy to identify the aircraft carrier below just as it's pictured that Naval airmen can name it at a single glance, you observing readers should be able to also. Nope, we're not trying to pull a fast one on you; if you've been reading POPULAR AVIATION carefully each month—especially the last three—you should be able to spot this carrier immediately. Seriously, though, the Navy has a standard and simple system whereby each carrier can be distinguished from its almost-identical sister ships. In the picture below there are two separate and distinct markings on the ship. If we could spare a billion dollars or so this month we'd gladly offer it as a prize to the first reader (outside of any Naval men, of course) who can tell us what those markings are and where they are. Look sharp, then drop us a penny post card.



Do Planes Lay Eggs?

AN amusing sidelight on the recent descent of the Imperial Airways flying-boat *Ceres* on Lake Dugari in Central India—an event which amazed natives who had never seen a large aircraft at close quarters before—has been the fact that empty mineral water bottles, as discarded by passengers and crew while the flying-boat was on the lake, were seized upon with avidity by the natives, being regarded as objects of exceptional value. It appears that such bottles, and particularly those with highly decorative labels, are now being traded regularly among the natives, their value varying according to size, color and design.

"It has always been interesting," remarked an airline official, "to study the reactions of natives on first seeing a flying machine. When, for instance, our mail planes first began flying across Africa, the natives referred to them wonderingly, as 'the great white birds,' while members of our airway staffs were spoken of, with awe, as 'the masters of the great white birds.'

"The story is told of one native who, after traveling a long distance through forests to reach one of our early landing-grounds, stood in speechless astonishment as a monoplane came gliding down. 'Would you like a ride on the back of that big bird?' an official asked him. The native, it seems, shook his head. Then he added, eagerly: 'But what I should like would be to take some of the eggs of that huge bird back to my village with me.'"

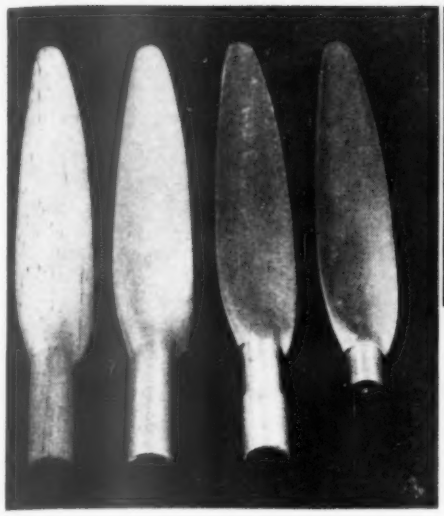
Those Four-Engined Jobs

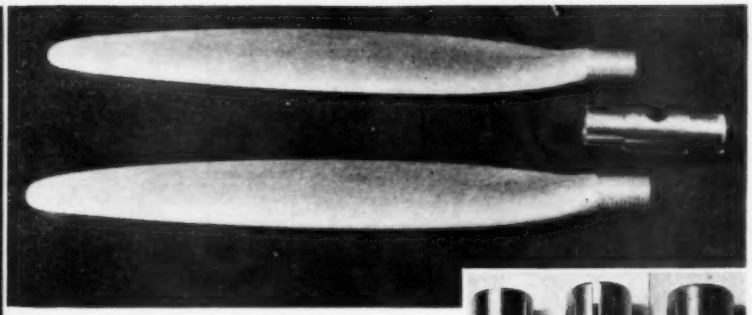
FOUR-ENGINED airliners are the prime subject among commercial aviation men throughout the world today. There are many who believe the four-engined airliner ahead of its time: economically unsound at the present time. However, in view of the fact that several four-engined giants are already built or being built, the manufacturers of the world seem to think otherwise. Herewith a comparative table of representative international four-engined transports:

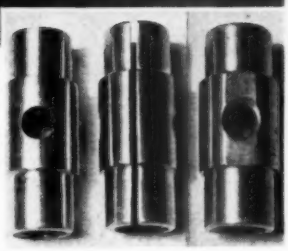
Type		Number of passengers	HP/passenger	Cruising speed in m.p.h.
Douglas DC-4	American	42	125	205
Boeing 307-S	American	32	156	250(?)
D.H.91 *Albatross*	British	20	100	198
A.W.27 *Ensign*	British	42	76	161
Junkers Ju 90		40	82	205
Focke-Wulf 200		24	115	200

Lucky Stockholders

A NEW method of acquainting stockholders with their company and its equipment, facilities, operations, and service practices, was conducted during the past month by United Air Lines, which permitted stockholders for a period of seventeen days to purchase a ticket between any two points on the system at one-half the published tariffs.







1 The picture at left shows blade construction from wooden pattern to completed blade.

2 Directly above is illustrated the simplicity and minimum of parts in the novel propeller.

3 Details of the metal hub are shown at right. Left to right are the front, side and back.

A METAL PROP FOR GAS MODELS

by LEO A. WEISS

Here is a novel workbench job for the gas model fan that will more than repay him for his efforts. Tests were most favorable.

DURING the past few years gas models have been following more and more closely the trends of design found in full-scale aircraft production. The introduction of streamlining, monocoque construction, scientifically designed undercarriages, better motor mounts and many other devices clearly shows that the gas model builder of today is open-minded to the extent of trying out new developments calculated to raise the performance of his model.

With this in mind, the author set about designing and building an all-metal adjustable pitch propeller which would be simple enough in construction to be built by the majority of gas model builders. The design was copied directly from the Hamilton-Standard Type 4412.

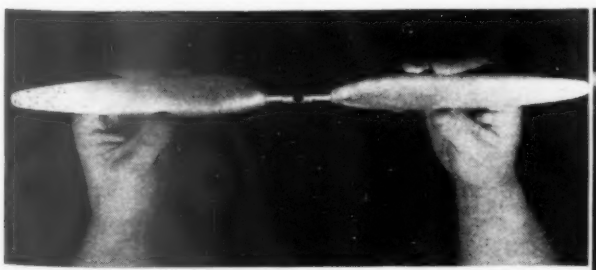
The need for a metal propeller will be realized upon investigation of the comparative efficiencies of wood and metal propellers. A metal propeller, size for size, is from four to six per cent more efficient than a wood propeller. This means that if a metal propeller the same size as your present wood one is fitted to your gas model, its maximum rate of climb can be increased from eight to twelve per cent. Such increases in rate of climb cannot be neglected. In addition, with an adjustable pitch propeller it is possible to set the blade angle to obtain the maximum efficiency, depending upon the speed of the model and the engine. Thus, if you want a high rate of climb, the propeller may be set accordingly. For weight lifting or some other particular job to be done by the airplane, the propeller setting will again be changed.

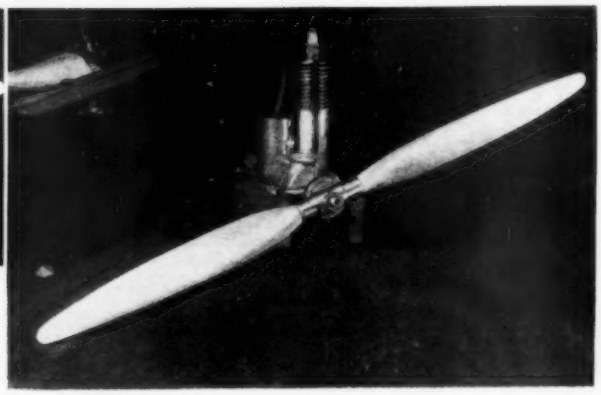
If a crack-up occurs with a metal propeller, most of the time only one blade has been bent and the hub is uninjured. It is an easy matter to remove the injured blade, replace it with another one, and check the balance of the propeller again. The cost of the blades should run between 20 and 25 cents apiece, hence you should not worry too much about replacement costs. Also, damaged blades may be bent back to original shape with a small hammer and a light anvil. However, do not attempt to reshape propellers that have been bent more than about 30° in angle.

The drawings are given only for a propeller of 15 in. diameter. Should you want a propeller of, say, 16 in. diameter, merely scale up the given drawings, but use the same hub. This hub will serve perfectly well for propellers up to 17 in. diameter and down to 13 in. diameter, merely by making the root section of the blades the same. Thus you can make different blades, but the same hub, and use the propeller on different motors.

Blades

Obtain a piece of pine, bass, or similar wood, 1¼" square, and 8½" long. Set





4 Above is the completed all-metal gas model propeller, showing comparative size of the ready-to-fly assembly.

5 The metal propeller is shown (right) mounted on a Brown engine. Maximum rate of climb is increased 12 per cent.

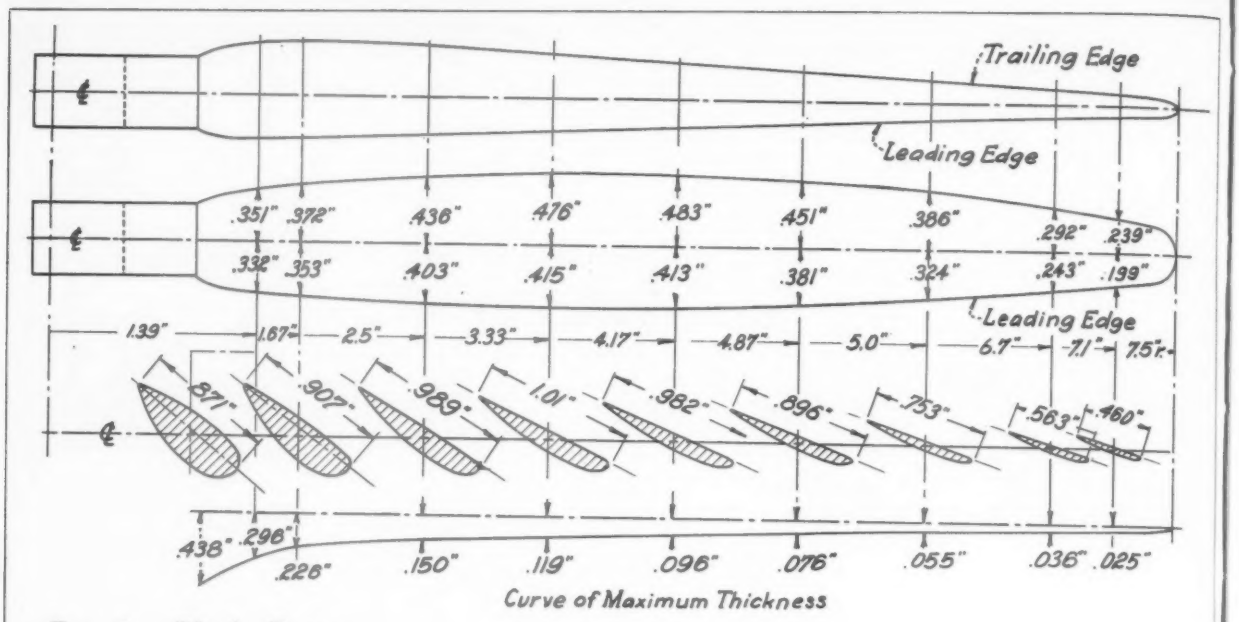


Fig. 1 Blade Pattern

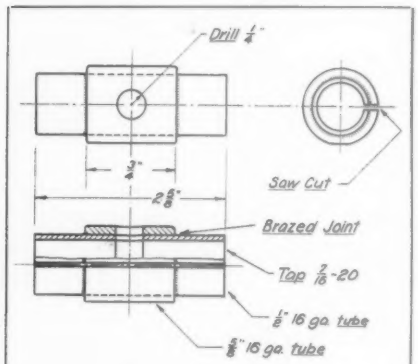


Fig. 2 Hub

this up in a wood turning lathe and turn the end nearest the tailstock down to $\frac{15}{32}$" diam. Make this turning down about 1½" long. Next make a template of the plan and side view of the propeller. These templates may be made from ordinary cardboard or Bristol board. Trace the templates on the block, making sure that the centerline of the templates lies along the same center line of the root that has been turned on the blade.

It is important to note that the placing of these templates one way or another on the block determines which way the propeller will turn. If you want the propeller to turn counter-clockwise, as is usual, place the templates on the block in a similar manner as they are shown in Fig. 1. Go very slowly here, and figure out what you are doing, or you will waste the block of wood.

The plan and side view outlines properly traced, cut to these outlines with a hand jigsaw, a mechanical jigsaw or a bandsaw. You now have an ordinary propeller blank with the exception that it has a circular root instead of the conventional rectangular one.

To shape the blade, use whatever method you are accustomed to in making wooden propellers. Follow the drawings given for each of the sections as closely as possible. If you have access to a pair of micrometers, make the thickness at each section as close as possible to the values given. If not your eye or a pair of outside calipers will be sufficient. Remember, the secret of higher efficiency lies in thin sections, so do not worry about the fact that the sections are thinner than for ordinary propellers.

When carving around near the circular root use pictures of full scale metal propellers, and those given here, pro-

(*Continued on page* 70)

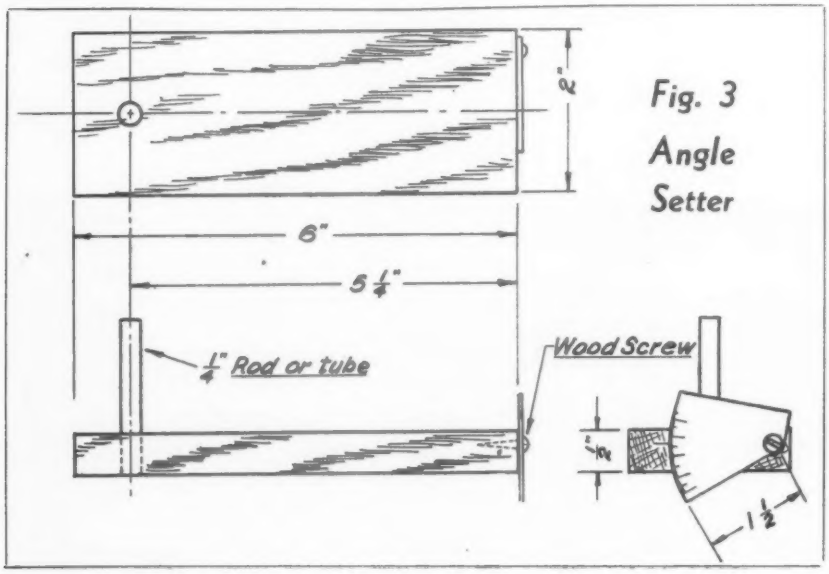


Fig. 3 Angle Setter

Max. Speed Model	Correct Prop. Diam.	Correct Blade Angle	Prop. Efficiency
m.p.h.	inches	degrees	%
15	16.5	10	52
20	16.38	12	62
25	16.25	14	68
30	16.0	17	73
35	15.13	19	77
40	15.0	22	78

Note:—Above data applicable to models with engines similar to the "Brown Junior."

Fig. 9

by

Lieut. A. G. J. WHITEHOUSE

Our article on spies in the September issue brought this retort. Which side are you on?

HAVE you a little spy in your home?

Have you taken any pictures of a P-26 lately?

Do you have a cousin who knows a man who has a sister who once went on a picnic with a guy who cuts clippings out of POPULAR AVIATION and sticks them in scrap-books?

If so, look out; you're likely to be nabbed as a spy any day now.

It's the open season on enemy espionage agents who are in America snooping for information on Uncle Sam's military planes which are being sold by the thousands to foreign countries.

Right now, I'm sitting tight hoping against hope. I have a blueprint of a Curtiss *Jenny* which came in a model airplane kit some years ago, and if the State Department finds out about it, I'll wind up in Leavenworth cracking rocks. Of course, I might eat the blueprint, but it's quite dusty by now.

I also have friends in Scotland who are careless enough to write to me now and again. My room is littered with sketches, maps, models and notes refering to military aviation—and golf scores, far from the low seventies.

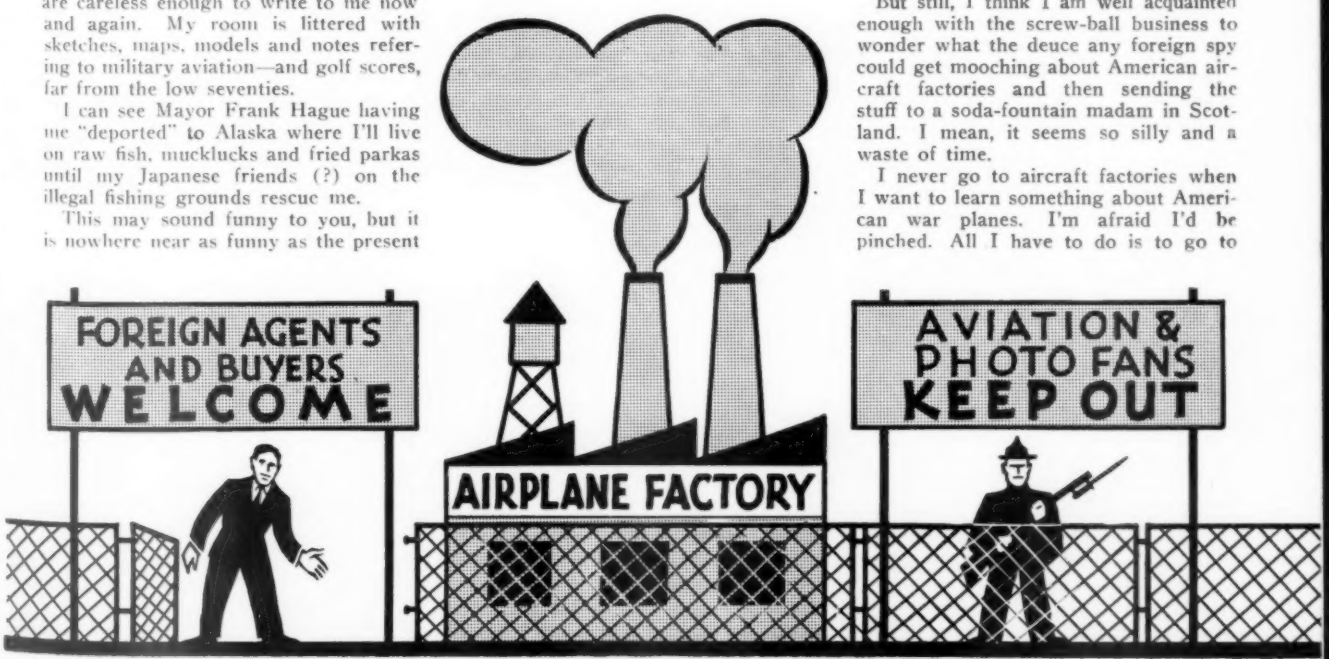
I can see Mayor Frank Hague having me "deported" to Alaska where I'll live on raw fish, mucklucks and fried parkas until my Japanese friends (?) on the illegal fishing grounds rescue me.

This may sound funny to you, but it is nowhere near as funny as the present "spy" scare that is playing to packed newspaper columns all over the country. According to the official indictments 18 persons with funny names like "Eric," "Crown," Jessie Jordan (who has been nabbed by the British, who love a good game), Udo, Otto and Johanna, are wanted for practicing espionage; and particularly for swiping the secrets of military planes, Navy codes and the under-cover signal systems used by military airmen in fighting formations. They are also charged with taking photographs, swiping blueprints, drawing sketches and gathering information on details of the national defense.

Personally, I have always been a push-over for a spy story. My bookshelves are crammed with volumes written about or by spies. In my particular silly occupation I often run a little dry on ideas and I am not above reading the odd spy tale now and then, to refurbish the old think-box. There are times, when I am very low of course; when I think I would make a swell spy for someone. I know all about it. The secret inks, the methods of passing on information, codes, and how much distance an infantry regiment takes up four abreast on the march. I was once taught how to blow up a bridge, put detonators in Mills bombs and the name of the front bone of a horse's leg. You see, I am a perfect character for the part. The only thing about it is that I'm afraid I'd get caught and stuck in the cooler. I always make some sort of bloomer, somewhere.

But still, I think I am well acquainted enough with the screw-ball business to wonder what the deuce any foreign spy could get mooching about American aircraft factories and then sending the stuff to a soda-fountain madam in Scotland. I mean, it seems so silly and a waste of time.

I never go to aircraft factories when I want to learn something about American war planes. I'm afraid I'd be pinched. All I have to do is to go to



Times Square and buy a few foreign aviation magazines and there it all is—pictures and everything. I'm still getting over the shock of finding complete detail photographs, showing guns, bomb-racks and structural features of the *Flying Fortress* in a foreign magazine, long before the Army guys had learned to fly one.

I used to know a few so-called spies during the war. They were all silly blokes who had made the mistake of getting an education which included German, so they were "elected". They'd sooner mooch about the Adlon Hotel in Berlin than do a four-hour patrol in a Bristol Fighter. As I say, they were all screwy somewhere, and they nearly all got picked up for dumb mistakes. The one they all seemed to make was to register as Herr Captain Adolph Von Stickyback, 235 Schmackelbonken Strasse, Pottsdam, when they should have written it "Schmackelbonken Strasse, 235". They usually wound up in a salt mine, the Germans being too soft-hearted to shoot them.

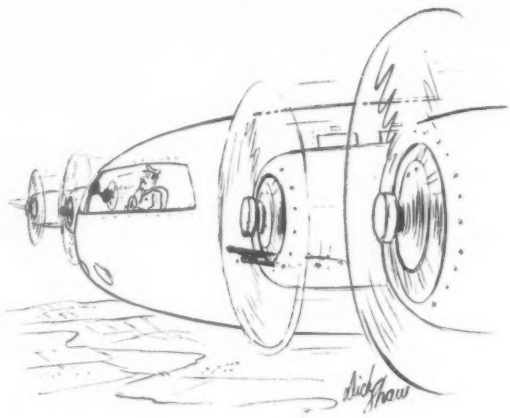
The same streak of mild insanity seems to taint the present crop of international spies. The people who are above them are screwier *pro rata* of course or they would never send them on such ridiculous tasks. If they want the full details of how American airmen signal to each other in the air, they would be much better off getting the April, 1935, issue of *Esquire* where one William Leroy Broun gave a complete and very well illustrated account of how it is done and the full code of the system. The same thing I believe has been done in other magazines including POPULAR AVIATION. It has also been fully explained in several books written by ex-Army or Navy pilots.

Of course, as you say, the system may change now and then, but even so, it can't be so awfully important, for if I remember rightly, I had all I could do in the old days at 130 m.p.h. to remember three main signals—whether I was giving them or receiving them. I think we would have all looked particularly dopey, slithering up to a formation of Huns and sitting there waiting for the leader to give a "secret" signal before we went about the business of doing something about an attack.

And then there is this gag about a guy getting a job with Seversky just to learn the great "secrets" of the new American fighters. What a laugh! Don't these people know that there are dozens of Severskys in South America and that if they cared, they could buy one all ready built, and Seversky will give them a beautiful illuminated booklet with it showing them how to tighten No. 675 nut. I do, because I have one of the lovely Seversky books, showing all the details of their ships. It is full of lovely drawings, lovely photographs and detailed illustrations. What is more it has a swell chart of the performance figures, so that you would know what she would do if you were two pounds overweight, suffering a boil on the right side of your neck and had your hair parted on the wrong side.

What a dopey game!

You can buy practically any military plane in the United States! The British had that opportunity a short time ago, and then handed us a back-handed compliment by placing a prospective order for some out-moded trainers and an awful lot of Lockheeds which are more transport than bomber. You can go into any aircraft factory in this country, if you have the appearance of a guy who might buy something, and they will show you all over the place from locker room to the girl's badminton court. Before me I have several copies of "The Bee Hive" the house organ of the United Aircraft Corporation. In all will be found a department called "Visitors" in which one will see that smart aeronautical engineers from practically every country in the world wander in and see how the military types manufactured by



that concern are put together. I will say, however, that few Germans seem to make use of the opportunity. There may be an answer to some of this, somewhere there.

But if German espionage service heads are willing to pay other mugs for swiping this available information, it is easy to see why a guy like Hitler can make them goose-step all over the marble game.

Just what is there in this or any other country worthy of the attention of any spy? Just what is there in any American aircraft plant that can be so important to any other country, or so valuable to their air defenses?

The most recent addition to the Army is the Boeing bomber, and half a dozen of those were flown to South America months ago, so that all the aircraft salesmen down there could look them over. The next addition (if they can find the promised cannon for it) will probably be the Bell *Airacuda*. Just what marvelous piece of designing or construction is hidden there that would make any other nation send out their Oswalds, Ottos and Henriettas to discover?

If you only look at a very smudged newspaper reproduction of the Bell *Airacuda*, you can tell that it is simply a low wing, pusher monoplane. It is obviously an all-metal fighter, although if it were made of hardened macaroni and covered with pressed cabbage leaves, what would be the difference? There have been pushers built before. Ships have been designed to carry high caliber guns and they have been made with various forms of metal construction.

But perhaps it is the power plants that are so important and hush-hush. They happen to be, according to five million accounts in the newspapers; the "new" 1,000 h.p. Allison engines. Plenty of hush-hush there. In my bible, *Jane's All the World's Aircraft* for 1937 (a British publication) they only have two detailed photographs of the engine and about 750 words giving full details of the engine and its construction. And I guess you or I could go to Indianapolis and buy one (to put in a motor boat) if we so cared.

I don't know. Maybe I don't see things right. The newspaper boys always tell me that there is so much secrecy about the aircraft plants whenever a new ship comes out. They write yards about the foreign spies who have to be kept out. The foreign spies all seem to be after the great secret of the new "air wonder".

What great secret?

I have been looking at airplanes—when no one else is looking, of course—for years. I have yet to see anything startling or amazing about anything in the military field, either here or abroad. The engines seem shinier and the cockpits have a few more gadgets and they put the guns in more inaccessible positions. They have jacked the power up about ten times and the speed about three, so what is there to get all fussed about?

They have the same wings, wheels and what-nots. There's nothing particularly new about them except slots and flaps, and I'm afraid to go back any further than 1911 to see if they didn't have those in the old days. They look pretty. I'll agree, but they seem to lose their wings now and then. The crew have to wear parachutes—even in peace time—because no one has done anything about making them safer. The guns still fire at about the same rate and the bombs are dropped in the same manner and they make as many misses as I did trying to hit the Douai railroad station back in the World War.

But no. The foreign spies still haunt the airports and factories to discover the new secrets of our military airplanes.

I'll make a small bet with anyone who is fool enough to take me up that any recognized American aircraft engineer could draw the plans of any foreign plane in the world, if you gave him a fairly good photograph, told him

(*Continued on page* 74)

A PLASTIC AIRPLANE

This Ship's Entire Fuselage Was Molded In A Few Hours

TO the average person the airplane pictured on this page is merely a trim-looking low-winger cabin monoplane. But describe the most unusual feature of this Clark F-46A to any experienced aviation man and he'll listen to you with bated breath. That is, provided you were able to tell him all the details of this startling airplane—which you're not, and won't be for some time.

The most intimate details of the F-46A are strict military secrets. The reason will be obvious when we tell you that the airplane on this page has a fuselage that was molded together in a little more than two and one-half hours! The material is a semi-plastic known as Duramold and apparently is a fairly complete success, considering the fact that the first complete airplane employing this process already has been tested and approved by the Civil Aeronautics Authority.

If the novel airplane reminds you of a Fairchild you have solid facts on which to base that assumption. The Fairchild company formed the Clark Aircraft Corporation on February 10 of this year. Fairchild is to have a 33⅓ per cent interest in the new company plus options on an additional interest. Under the direction of Harold Clark, who developed the Duramold process, the original airplane was built at the Fairchild plant in Hagerstown, Maryland. Little detailed information is available on the Duramold process although it is known that the F-46A's fuselage was formed by molding the material in two halves and joining it at top and bottom. The ship is powered with a Ranger engine of 450 h.p. which gives it an estimated top speed of 230 m.p.h. So far as is known, the wings are not Duramold. They are reported to be plywood-covered. The ability to mold military aircraft in large quantities in a minimum of time in a national emergency makes Duramold well worth watching.

"Time Flies" Gets Face Lifted

THE two airplanes above are basically one airplane. That is, the sleek monoplane in the upper photograph is simply the late Frank Hawks' old *Time Flies* (lower picture) in a new dress suit. When Hawks gave up speed flying to go into the safety-plane business, he shelved his white racer. The Miller Aircraft Company of Springfield, Mass., (also known as the Military Aircraft Corporation) took the ship over and decided to rebuild it into a high-speed pursuit ship.

Air Corps' New Rescue Boat

LATEST addition to the Army Air Corps is a boat. It is a newly-designed high speed airplane rescue boat to be used by the Air Corps at its base in Hawaii. Powered with two 600 h.p. engines, the P-11, as it is called, has a top speed of 31 m.p.h. Included in the boat's equipment are a medical dispensary and six litters for injured persons. The boat is also equipped with powerful two-way radio. The A-frame derrick seen on the rear of the P-11 in the photograph below has chain falls and wire stays designed to support partially submerged wreckage during rescues. The boats are soon to be delivered.

Two in One

FOR more than two years the Lockheed Aircraft Corporation has been working with the Menasco Manufacturing Company on a new development. The project is a new method of gearing whereby two complete and separate inline aircraft engines are coupled together in a side-by-side position to drive one propeller. Either engine may be operated independently of the other without any drag being transmitted from the inoperative engine. This, it is claimed, gives a tremendous safety margin in the event of engine failure. The basic thought back of the development has been to combine the best safety features of twin-engine power with the simplicity of single engine installations. The two engines are separate and independent power plants but combine to drive the one variable pitch propeller in such a manner as to eliminate any necessity for synchronizing the two engines.

This new development is called "Unitwin Power," and several installations have been undergoing rigid test-stand runs at the Menasco plant. The two engines used in the present tests are Menasco C6S-4 stock models, each delivering over 250 h.p.

The test-stand runs of "Unitwin Power" have been conducted in closest secrecy up to this time. It is said that these tests have proved the installation to be extremely satisfactory. Since, however, block tests are never thoroughly conclusive, it has been decided to run a series of exhaustive flight tests. A special Lockheed *Altair* has been prepared and will be used as a "flying test-stand" for the next several months. It is planned to run the new engine installation hundreds of hours under severe operating conditions at various altitudes and in varying temperature ranges.

Pilots' Ear Saver

THE crashing of static, so painful to the ears of pilots flying during electrical disturbances, has been eliminated with the development of an "ear saver" static filter by the Aeronautical Radio Co. of Roosevelt Field, N. Y. Placed in a series with the headphones, the new device prevents excessive voltages from reaching the headphones and "levels off" headphone volume surges.

In normal operation, the pilot adjusts the audio volume of the receiver to a comfortable level of headphone voltage —four to six volts. Headphone voltages in excess of 12 volts (the "pain level" of the human ear) are always painful and render the ear temporarily insensible to normal beacon signals. At their worst, these voltages can inflict a serious injury to the ear. Static crashes have been known to produce momentary voltage surges up to 30 volts, far above the pain level.

Elementary Wing Beam Design

by PEYTON AUTRY

Of vital importance to amateur builders is the design of wings

There seems to be some indication that the new Civil Aeronautics Authority looks upon the "home-builder" with a kindly, fatherly eye. Especially now that the new regulations almost ban unlicensed ships entirely. Anticipating some new legislation possibly favoring the amateur, we continue using "how to build" articles.

THE amateur airplane builder has now come to the stage where he is ready to accept advanced ideas to incorporate in his homebuilt designs. One of the first things for him to accept is the use of cantilever wing construction. Since it is almost impossible for him to adopt all-metal structures for a wing, his only alternative will be to use wood construction and a plywood stressed skin covering or internal bracing of sufficient torsional rigidity. It is obvious that the success of such a structure will depend to a certain extent upon the design of the wing beams, which are actually the heart of the structure. Of course, there are various other stresses which must be duly found as regards the beams, but in all probability the bending stresses in the beams warrant our first hand investigation more than any other. It is the wish of the author that this little article will be an inspiraion to the amateur for delving further into the subject of stress analysis.

As an example let us take a box type beam (which is an ideal type for cantilever structures of long span) 200 inches in length with plywood webs and spruce flanges. This beam is in pure bending, supported at one end. It is uniformly loaded at 61 lbs. per inch run. This beam is illustrated in Figure 4.

First, let us find the properties of the beam: To find the allowable unit stress on this beam we must employ the chart in Figure 1. Therefore, must find the value of tc/h on Figure 1 which is the ratio of the compression flange

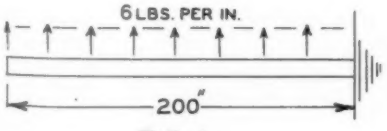


FIG. 4

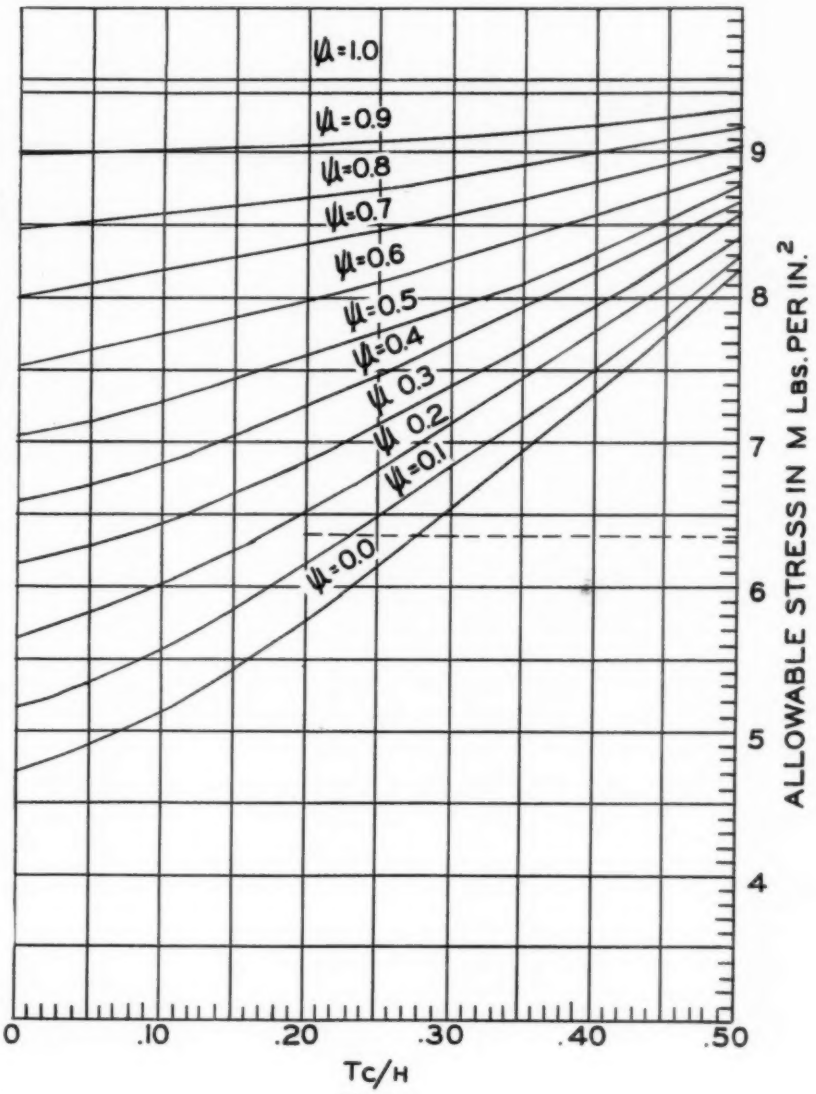


FIG. 1

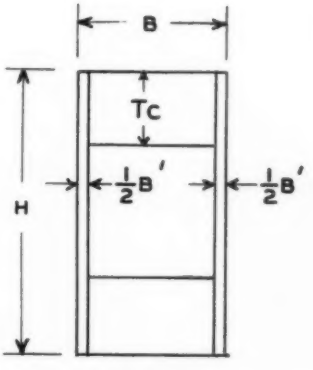


FIG. 2

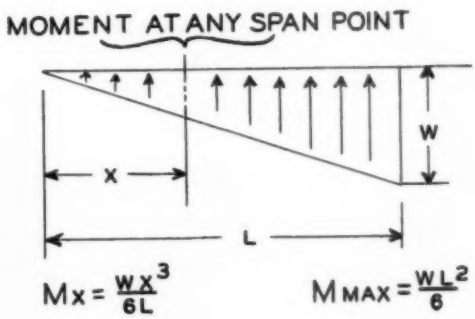


FIG. 3

(top flange when load is acting up) thickness to the height of the beam. This is illustrated in Figure 2. Also, we must find the value (u) which is the ratio b′/b or the ratio of total web thickness to the width of the beam. This is illustrated in Figure 2, also.

Then:

$tc/h = 2/10 = .20$

$u = b'/b = .375/2.375 = .158$

Then the allowable stress or modulus of rupture as found on Figure 1 is 6,350 lbs. per sq. inch. This is illustrated by broken line in Figure 1.

The maximum bending moment must next be found and the following formula for uniformly loaded cantilever beams is employed:—

$Mmax. = \frac{1}{2} w l^2$

where—

w = beam loading

l = beam length.

$Mmax. = \frac{1}{2} \times 6 \times 200^2$

$Mmax. = \frac{1}{2} \times 6 \times 40{,}000$

$Mmax. = 120{,}000$ in. lb.

The next step is to find the location of the neutral axis. This is shown in Figure 5.

(top flange) $2 \times 2 = 4.00 \times 9 = 36$

(lower flange) $2 \times 1 = 2.00 \times .5 = 1$

Area = 6.00 37

Note: The value of 9 is the distance from the bottom of the beam to the centroid of the top flange. The value .5 is the distance from the bottom of the beam to the centroid of the lower flange.

Neutral axis = 37/6 = 6.16 inches above bottom of beam.

The next step is the calculation of the moment of inertia.

$I = \frac{2 \times (2)^3}{12}$ plus $2 \times 2(2.84)^2$ plus $\frac{2 \times (1)^3}{12}$ plus $2 \times 1^3 \times (5.66)^2$

$I = \frac{2 \times 8}{12}$ plus $2 \times 2(8.15)$ plus $\frac{2 \times 1}{12}$ plus $2 \times 1 \times 32$

$I = 16/12$ plus 32.6 plus 2/12 plus 64

$I = 1.33$ plus 32.6 plus .166 plus 64

$I = 98.09$ in.^{4}

Then to find the required stress by the bending formula:—

$S = M\,y/I$

where—

S = stress

y = distance from N.A. to outermost compression fiber

I = moment of Inertia

M = max. bending moment

$S = 120{,}000 \times 3.84/98.09$

$S = 460{,}000/98.09 = 4789$ lb. per sq. in.

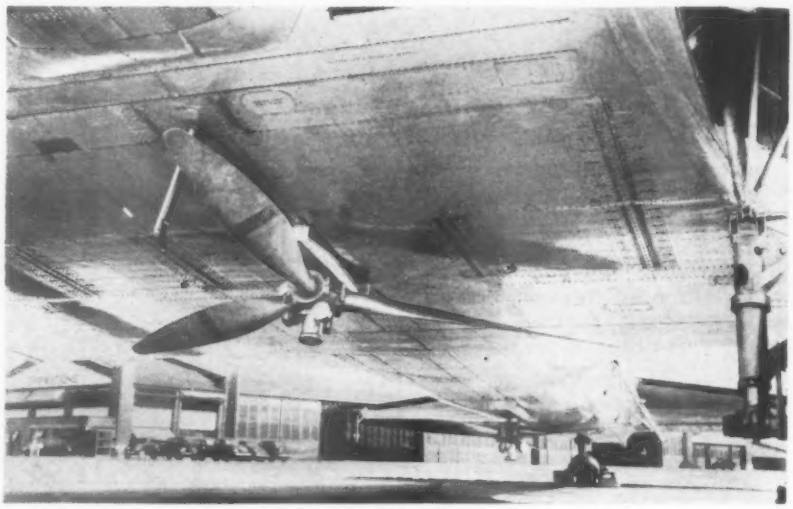
Then to find the margin of safety of the beam.—

$M.S. = 6350/4789 - 1 = .32$

The ideal cantilever wing is tapered and formulae, etc., applicable to this type are illustrated and written in Figure 3. In this type the beam is tapered and for this reason it is well if the margin of safety is calculated at various stations along the length of the beam.

END

How the Army Ships Propellers



THE Army Air Corps had the usual difficulties in transporting propellers in an emergency—until engineers concocted the solution pictured above. Clamped to the underside of one of the Army's Douglas transports are two full sized three-bladed props. Test flights already have been made and the device called a success. This, however, is for emergency use only.

An Aviation Fog-Finder

FOR warning aviators of areas of low visibility due to fogs, a new device has been developed by weather forecasters.

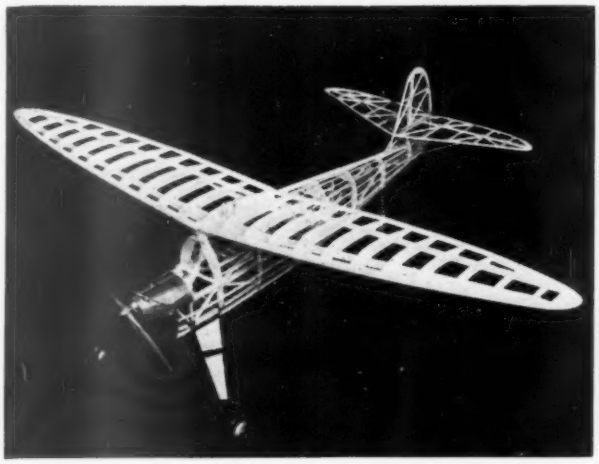
In some parts of the country, an abnormally warm layer of air at a height of several thousand feet precedes the formation of a fog by several hours. Where it is possible to discover this warm layer promptly an advance notice of low visibility may be radioed to aviators.

The fog-finding device is carried up by small balloons inflated with hydrogen. If the atmospheric temperature decreases steadily, as the balloon rises the recorder goes quietly on its way. But when the temperature starts to rise the instrument gives signals which are seen by the observer. At night, a light is sent out as a signal and in the daytime, the signal is given by the releasing of a small white paper parachute or some similar object.

The indicator is called an "anathermoscope" and consists of a V-shaped bar about ten inches long made from a sheet of steel about the thickness of paper and a very fine nichrome wire of the same length. This nichrome wire responds to temperature changes more quickly than the steel bar and when the recorder hits a warm spot it lengthens so that a contact between two tiny batteries and the signal giving device at the instrument's end is closed.

The electric current may light a small bulb or burn the string holding the paper parachute. With a theodolite on the ground the observer sees the signal and figures the height of the layer of warm air. With this information he can figure when fog or low clouds will begin to form and the information broadcast to pilots will warn them of approaching low visibility.

The fog-finder is compact, easy to carry.



The Jitter Bug is ruggedly constructed, yet well streamlined.

The finished model is attractive as well as efficient.

Building the Jitter Bug

by PAUL W. LINDBERG
Model Editor and Designer

This month's gas model was designed primarily for flying in high altitude competitions.

MOST of you model fans are desirous of building a contest model that will climb to a very great height for a given amount of motor run depending upon contest rules. You will thrill at the steep spiral climb which this model will maneuver. At the top of the climb it will flatten out and glide for a long time, depending upon air conditions. This model with its beautifully streamlined fuselage, painted in bright red and with its silver nose, makes a very striking appearance wherever flown. By increasing the plans four times the size shown in magazine, the correct size will be had for the construction of your model. A larger model may be built by increasing the plans as many times as you so desire. Our model of this particular design has flown so remarkably well that we advise you to build it the same size as ours, which is four times that shown in magazine.

Construction of Fuselage

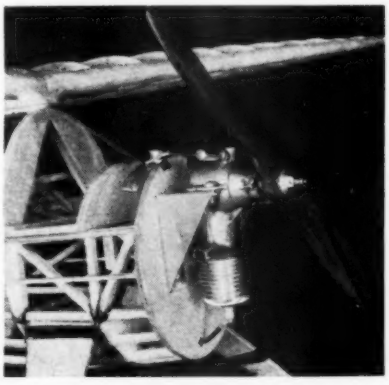
Secure some ⅛-inch square hard balsa strips for the building of the rectangular shaped inner fuselage. After making sure this part of fuselage is absolutely true, the formers are next attached. These are cut from ⅛-inch balsa. The ⅛ by ⅛ inch hard balsa stringers are next attached. Positions of these are shown through the various sections of fuselage shown on plan. You will note on the plan, small sections of the formers are cut out between stringers as indicated by dotted lines, so as to give a neater covering job. A great deal of construction is required around the cabin which is composed chiefly of ⅛ inch square balsa to support the strain from the wing.

Construction of Landing Gear

This is formed from ⅛ O.D. piano wire being securely tied into fuselage with strong thread and cement. Struts may be faired in with ⅛-inch sheet balsa so as to add to the appearance. Streamline wheel coverings may be added if so desired but are not necessary. These are used chiefly for display purposes.

Construction of Elevator and Rudder:

The elevator is built upon a flat surface from ⅛ inches square and sheet balsa. There are two sections to this elevator, one left and one right, and they are cemented well up on the rudder support by two struts on each side of bottom side of elevator. The elevator is not cemented to rudder until it has first been covered. If you will notice closely, the rudder is very neatly faired into rear of fuselage, this being done mostly by the method of attaching the bamboo paper between the rudder and fuselage. When shrunk with water it forms a perfect fillet on either side of rudder. The aluminum tab in the trailing edge is used for directional control. This tab is very sensitive and need be only bent a small degree at a time so as to not over-control the model.



Close-up of the model's engine mounting

Building the Wing

A great number of ribs have been built into this wing so as to gain an efficient air foil section as well as one that has a great deal of strength. It is advisable to build the wing in two sections, one left and one right panel, and glue them together at the center, after they have become completely dry. The trailing edge is notched to receive the ribs. Reinforcement spars are cemented in at the center of the wing to prevent it from collapsing in flight. The wing as a whole pivots around the block cemented to the center ribs. This method of attachment is used so that if model should come in on one wing tip, it will be forced back to prevent any serious damage.

Details

The installation of motor, batteries, coil, tank, etc., are clearly described on plan so no trouble should be encountered here on your part. The front cabin section which carries the windshield is completely removable so that inspection and installation of new batteries may be had through this opening.

Covering the Model

This is one of the most important steps, as a poorly covered model is looked down upon by the average model

(Continued on page 78)

JITTER BUG
THE UNDERDOG HOBBIES
SECTION 1 FIREWALL
TOP
SECTION-3
F-3A
F-3C
SEC-4
SEC-5
SEC-6
SEC-2
F-2A
F-6A
F-7A
SECTION-6
SECTION-7
ELEVATOR
LEFT PANEL
RIGHT PANEL
NOTE RIB TEMPLATE SHOWS LOCATIONS OF SLOTS FOR SPARS
DIHEDRAL 3°
SIDE VIEW
TOP VIEW
FRONT VIEW
PROP LAYOUT
WIRING DIAGRAM
COVER
MOTOR COWL .020 ALUM
COIL
POPULAR AVIATION NOVEMBER 1938

Test Your Ship's Performance

by RAOUL J. HOFFMAN

The mere reading of the instruments in an airplane's cockpit does not always tell the truest story. Here are some novel tips for the amateur seeking his ship's abilities.

ONE of the most interesting, and at the same time educational, tasks offered to the designer or the builder after his new plane has made its initial flights, is testing the ship for performance, especially speed. The results obtained will not only give the builder an actual check against the predicted performance but also data showing where adjustment should be made on the present ship or improvements to be incorporated in future designs.

Accurate scientific testing requires costly instruments, which the home-builder cannot acquire or even borrow. Scientific testing is done with two to four movie cameras (Section 1) controlled and operated simultaneously from a central unit taking exposures at exact time intervals. The developed film placed in a special projector gives the position of the plane at any time, thus the take-off distance, the climbing speed, the top speed, the gliding angle, the gliding speed, the landing speed and the landing run can be determined from a single roll of film.

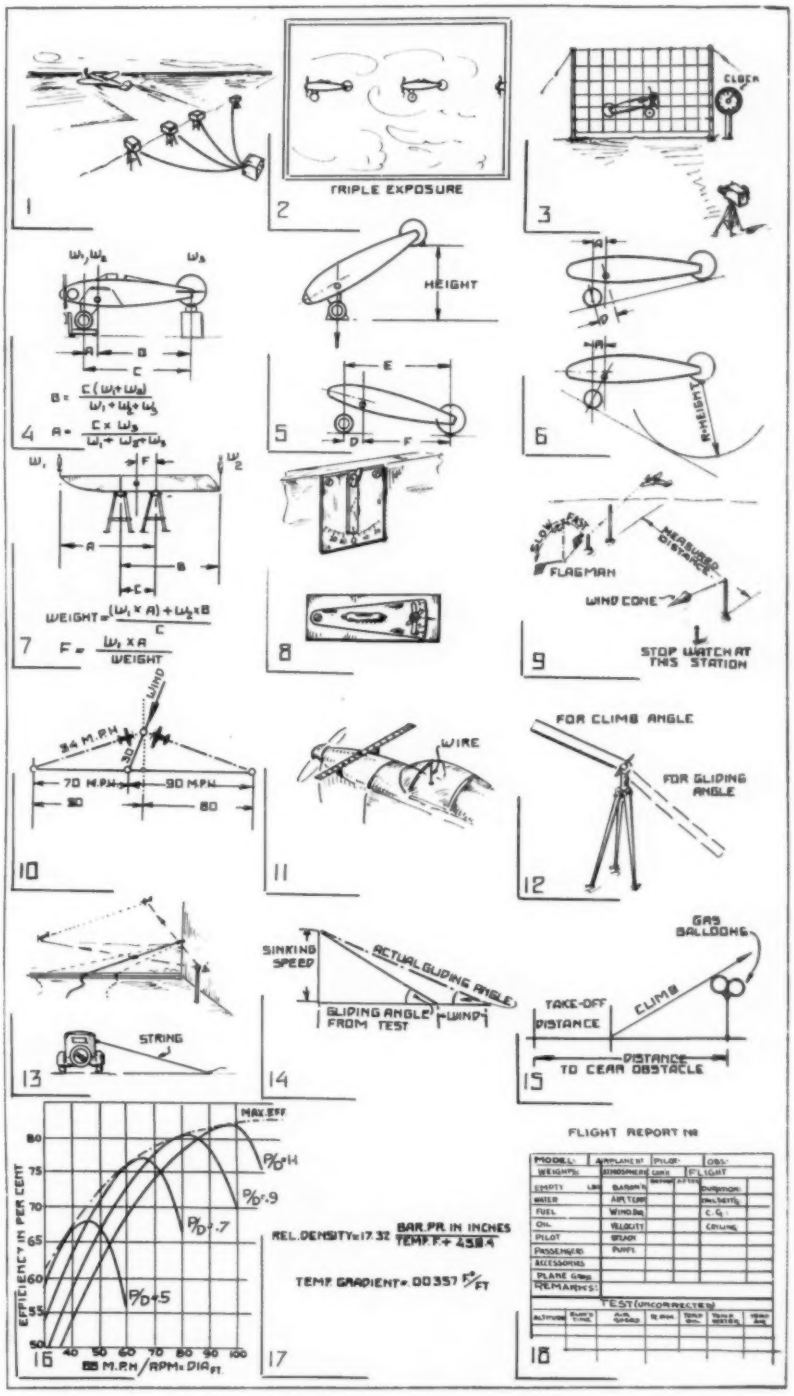
For obtaining landing conditions of a plane, a single movie camera will suffice if a screen and a stop watch is placed between the camera and the plane as the sketch in Section 3 indicates. Very often the stop watch is built right into the camera.

Attaching a rotating diaphragm to a standard camera so that it will give three exposures at the correct shutter speed would allow one to calculate the speed if the length of the plane and the revolutions of the diaphragm is found (Section 2).

There are numerous other instruments that are usually carried on the plane and automatically record the thrust and torque of the propeller, the angle of attack, the forces on the controls, the accelerating forces and other movements. But they are specially built and expensive.

The builder of experimental planes can do his own testing if he has the price of a stop watch. Even the stop watch is not necessary if he can count to five, for the regular pocket watch ticks five times a second; with previous practice the time counted will be as close as the one indicated by a stop watch.

Before starting with the tests a three-view drawing or at least a side-view drawing giving all general dimensions should be prepared. The scale chosen should be large so that direct measurements can be taken from the drawing; it should show the location of all useful loads to obtain the center of balance.



To determine the center of balance a platform scale is placed under each wheel and tailskid. This method is usually used by manufacturers. However, one scale will suffice if the other two points are always at the same height during the weighing process, and the thrust line of the plane horizontal. The weight of the plane is the sum of the three loads, and the location of the line passing through the c.g. (center of gravity) is determined by the formulae noted in Section 4. The actual position of the c.g. may be found by two methods outlined in Section 5. The plane, with its wheels blocked, is lifted until it balances in a tail high position. The height of the tail skid is then measured to the ground. Caution should be taken that the tail skid is in the same compressed condition when weighed on the scale. The other method is similar to weighing the plane with horizontal thrust line, it weighs the plane in a resting-on-the-ground position.

Section 6 shows how a graphic layout will obtain the position of the c.g. employing both methods. Care should be taken that the deflection of the tires is considered and applied to the drawing.

Section 7 shows an interesting problem of weighing a unit that is heavier than the scale is able to indicate. The supports must be placed at a distance not to overreach the limit of the scale. This method is suitable for weighing fuselage, wings or other large and heavy units during their production with a 25-lb. spring scale. The formulae are also noted in Section 7.

Above-mentioned methods could be employed to find the center of balance of a plane with pilot and fuel, but usually the new position of the c.g. caused by the addition of the useful load is calculated by the methods of moments. Each weight is multiplied by the distance from a fixed line usually passing at the propeller flange. All moments added and divided by the sum of the weights will give the distance of the c.g. from the propeller flange. This method is also applied to figure the distance of the final c.g. relative to the thrust line; for correct results the moments of the weights above the thrust line are positive and the one below the thrust line has a negative sign.

Usually the c.g. is close to the thrust line and therefore only the horizontal position of the c.g. is calculated for testing purposes.

The ground crew for speed testing should be composed of two but not over three members. All details must be discussed before take-off; the exact weight of the fuel and pilot must be recorded. A protractor should be fastened to the inside of the plane to give the exact position of the plane in the air. Section 8 shows two designs. One with a pendulum that may be secured during flight or one with a fluid level that must be adjusted during flight; both may be checked for angle after the flight. The tachometer, if run on half speed should have a new or temporary dial mounted showing the correct readings. If possible, a wind-speed indicator (anemometer) should be borrowed. The temperature and the barometric pressure, necessary in exact tests can be taken from the daily papers.

After locating a testing field, a certain distance, usually a mile (5,280 ft.), should be marked off that is easily spotted by the pilot. A map may give one the points required but if a road is close to the field a car with a correct speedometer will serve as a surveyor in laying out the mile.

The flights should be conducted at a height where the effect of the ground is small; for light planes 200 to 300 feet will suffice. The run should be made in a straight line without previous diving. If two stop watches are used, as often suggested, they should be started at the same time and stopped as the plane passes each mark. The time difference indicates the elapsed time. This method is tiresome, for the mile distance must be covered after each run.

"I said report for work in a *pilot's* uniform!"

A simpler way is the use of a flagman on one end to signal the passing of the plane. A sketch in Section 9 shows the arrangement. The stop watch is started as the plane passes and the flagman raises the flag slowly as the plane nears the other mark and drops it fast as it passes giving the signal to the timer. A small wind cone flown will give the direction of the wind. Usually four runs are made with each speed, two up-wind and two down-wind. Tests are made for top speed, for cruising speed, and for slowest possible speed, where controls are yet effective. During the tests the pilot records the r.p.m., the angle of position, and other details valuable to the builder and designer, such as the position of the stick, stability, vision, necessary movement of the controls, etc.

From flight reports the speeds can be determined by dividing 3,600 by the elapsed time in seconds if the distance was one mile. In case a crosswind was present, the graphic method illustrated in Section 10 is used. It shows that, even in a 30 m.p.h. wind, the average speed is reduced by only four m.p.h. Naturally flight tests are not made in a 30 m.p.h. wind.

To keep on a straight course, a graduated rod may be fastened over the cowling, a wire placed vertically in front of the pilot; sighting the markers on the divisions of the rod when flying a straight course the drift angle may be calculated or if necessary marked on the rod, as shown in Section 11.

The take-off distance is measured after the point is located by inspection; the same method is used for the landing run.

The time for take-off and the take-off speed is obtained on a car driving alongside the plane; the driver signals to the passenger when the landing gear leaves the ground; then the passenger notes the speed on the speedometer and at the same time operates the stop watch. The same method is used to obtain the landing speed. These tests should be made on a calm day.

The magnitude of the climbing and the gliding angle is very important for new or unorthodox designs, in order to prove the advantage of any new details.

A straight-edge fastened to a tripod (Section 12) may be used for approximating the climbing angle in upward position and for the gliding angle in a downward position. The plane is sighted over the swivelling joint from a fixed point and the straight edge adjusted so that the plane moves along the edge; the angle is measured after the test with a protractor.

The climbing speed and sinking speed must be taken by the pilot; a good altimeter and a stop watch will do the trick. For scientific investigations the r.p.m. of the engine should be recorded during the flights. These tests require a very active pilot; we may call him "test pilot".

For better results the arrangement sketched in Section 13 should be used. A cord is attached to the hangar door with the assistant holding it to the ground parallel with the line of glide. The plane is sighted at the attachment from a fixed point. Then, as it glides down, the cord is moved so that it appears always along the cord. The height of the attachment and the distance of the cord on the ground is the gliding angle.

In the absence of a suitable fixed object on which to fasten the cord, the door hinges of a car may be used and the apparent gliding angle found as mentioned.

(Continued on page 89)

Letters

Volcano

Sirs:

In your August issue you presented a short resume of the bombing of Mauna Loa. As several of the details were wrong, I thought I would put you right on them.

The 1935 eruption . . . was one of the biggest in recent years. The lava, contrary to popular belief, did not pour over the rim of a volcanic crater, but emerged from a fissure in the side of the mountain . . . After it had flowed for three days, Dr. Jaggar, local volcanologist, saw that the water supply for the city of Hilo was in danger of being cut off. This was really the only danger from the flow. There were no villages in the flow's path . . .

The worst mistake in your article was in attributing the bombing to the Navy. It was really the Army that did the good deed. When Dr. Jaggar's request for aid was received, seven Keystone bombers and two observation planes were dispatched from Luke Field. . . . Each plane carried one 600 and two 300 pound bombs. They used the lighter bombs for sighting shots. Bombing the front edge of the flow would have been futile, so the bombers aimed for the fissure from which the lava was flowing. Their accuracy was amazing and the experiment was a perfect success. A few hours after the bombing the flow slowed considerably and finally stopped altogether . . .

A very interesting sidelight of this bombing took place in January, 1936. At the time of the bombing the old Hawaiians said that such an act would arouse Pele's wrath (Pele is the fire goddess). They said that she was sure to get revenge. . . . It may be only a coincidence, but one night as the 72nd bombardment squadron was returning from night formation flying, two of their planes collided over Luke Field and crashed in flames. Every one of the eight men who perished had taken part in the bombing a few months before . . .

W. J. West, Jr.

Honolulu, Hawaii.

Catastrophe

Sirs:

Since Les Long wrote up the article on my construction and which you were kind enough to publish (POPULAR AVIATION, July, 1938) I have received hundreds of letters from interested persons. Yesterday our little factory burned to the ground and we were unable to save anything. The three designs under construction and five motors, pictures, blueprints and all the data were destroyed.

What bothers me most is that all those letters were unanswered and, of course, the addresses are unknown to me. In your next issue could you announce the news of the fire and request that they write again?

We are already erecting another building and will start in again constructing . . .

George Yates.

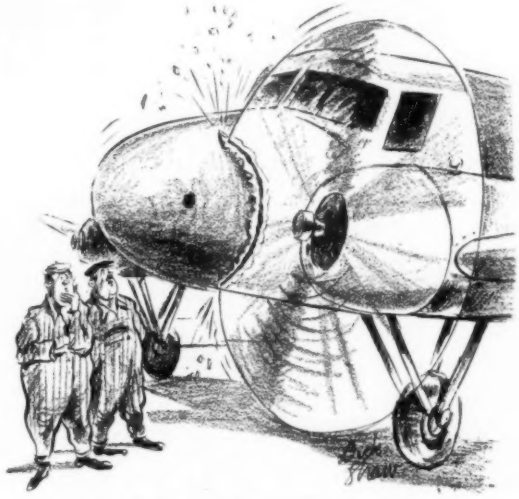
Beaverton, Oregon.

Trans-Atlantic

Sirs:

. . . In your August issue there is a paragraph which seems to me to be badly misinformed. It is the one regarding Atlantic flights in (The Man Under the Hood). He says that Pan American will be ready to start a scheduled service as soon as the first Boeing 314 is ready and intimates that it is only British policy which prevents this.

Well, really that's a very silly statement to make. I give your very estimable Pan American Airways credit for more sense than to start a *scheduled* service with only one plane. And that a virtually untried one . . .



"D'ya think we oughta use a smaller prop?"

The second part of his paragraph is perhaps even worse. He states that Imperial Airways have no equipment to compare with Pan American's. In other words five of the new Short *Cabot* class (the higher stressed Empire boats), two D. H. *Albatrosses,* to say nothing of the *Mercury,* cannot compare with one as yet untested Boeing 314 . . .

J. B. Seales.

Waverly Mount,
Nottingham, England.

● Reader Seales let his patriotism run away with him. The Man Under the Hood made no such statement, said instead: ". . . Pan American will be ready to start carrying mail, passengers and express across this ocean after one of their new Boeing ocean passenger-carrying flying boats has been checked out over the route," meaning that Pan American would open service following approval of that *type* airplane. Once survey flights with the Boeing start, additional "314's" will be delivered to Pan American regularly. True, however, is the statement that Pan American cannot open trans-Atlantic until the British are ready; that is part of a reciprocal agreement for landing rights between the two nations. Meanwhile, the Boeing is far from being "untested". At this writing several very gratifying test flights have been completed successfully, both in a loaded and unloaded condition. We have yet to hear, however, of the first test flight of a *Cabot,* while the *Albatross* recently broke in half on a landing. The *Mercury* is by far the least practical of Reader Seales' trio. —Ed.

Imperial Mistake

Sirs:

Thank you very much for . . . "Bermuda By Air" in your October issue in which you have done both firms (Imperial Airways and Pan American—Ed.) very handsomely. . . .

In view of your very generous treatment of us it would be churlish of me to suggest any amendments, but I must draw your attention to one slight inaccuracy on page 2 of the article . . . where you say that *Cavalier* is little more than one year old. The first of these Imperial boats was flying in September, 1936, and one year before that they were already taking shape. . . Your own experience in the aircraft industry will tell you how long the machine was designed before the actual completion date, so that if you say that the *Clipper's* design and accommodation are basically six years old, three or four years would be comparable dates to quote for *Cavalier*. . . I hope from time to time that POPULAR AVIATION will recognize our activities. I certainly will always recognize POPULAR AVIATION. . .

G. J. Powell,
Manager.

Imperial Airways Ltd.,
Darrell's Island, Bermuda.

Wanted—a Lightplane

Sirs:

. . . I possess a four cylinder 40 h.p. Church Marathon J-3 model engine. R.P.M. (with a five-foot prop) at 2500. Where can I find a lightplane? . . .

Clarence E. McCain.

Benoit, Mississippi.

Insignia Trouble

Sirs:

Early last Spring my good friend Lt. Clabaugh, U.S.N.R., asked me to prepare some designs for an insignia for the Glenview (Ill.) base, to be submitted to the men at the (U. S. Naval Aviation) base for their approval. . . . I am somewhat inclined to question the authenticity of the article relative to the base insignia that appeared in your August, 1938, issue . . .

Stanley R. Paterson.

Chicago, Ill.

● Artist Paterson's sketches were submitted to the Naval base for consideration along with more than 50 others;

POPULAR AVIATION'S art department has yet to see any of the Paterson sketches. The insignia now on the fuselages of the Glenview base's Grumman FF-2's and Berliner-Joyce OJ-2's was conceived by POPULAR AVIATION'S artists, officially approved by the Navy Department in Washington on April 12, 1938. A member of this magazine's staff collaborated with the Glenview base's commanding officers even in determining the size the approved insignia would appear on the squadron's airplanes. That insignia is on the ship on the front cover of this issue. —Ed.

Calculators (Cont.)

Sirs:

Due to the extreme shortness of our line (30 miles) we have been unable to put into practical use your flight calculator. Later on some of the pilots expect to make reasonably long flights in other equipment and on completion of these shall be pleased to send you their reactions.

WALTER L. SEILER,
Vice-President &
General Manager.
Wilmington-Catalina Airline, Ltd.,
Avalon, California.

Sirs:

At the time I received (my calculator) I was attending a class on navigation and meteorology at the Duck Air School of the Oakland Airport. Our instructor was Captain Voortmeyer, a very able navigator . . . I believe he was the man who designed the compass swing-table seen at most of our leading airports. He was quite taken up with the "little gadget" as he called it. I figured out his blackboard problems so fast that he was very doubtful about the answers, and it was only after working the flight calculator himself that he was convinced of its speed and accuracy. . . . All the fellows at the airport who have seen it seem to believe it is the answer to all their "navigation nightmares" . . .

KEITH TOMLEY.
Hayward, California.

Sirs:

. . . This flight calculator has been of inestimable help to me on long cross-country flights. It relieves me of the tedious work of lengthy calculations and it gives me the correct answers in the least possible time. I believe the POPULAR AVIATION flight calculator is a genuine contribution to aviation.

BARONESS LISETTE VON KAPRI.
Roosevelt Field,
Mineola, New York.

Sirs:

. . . After using it on several trips, I would not like to dispense with it.

P. L. MCMULLEN.
Oakland, California.

Sirs:

I have not had a chance to use the calculator very much, but the few times I have used it I thought it very good and look forward to using it more.

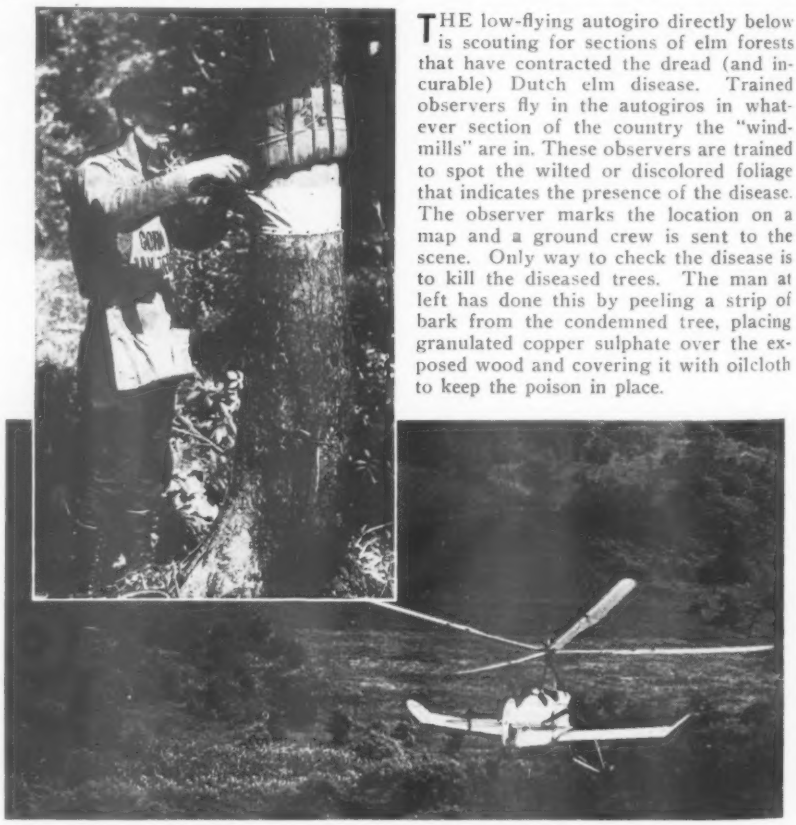
LIEUT. S. H. MURPHY.
U. S. Army Air Corps,
Barksdale Field, Louisiana.

END

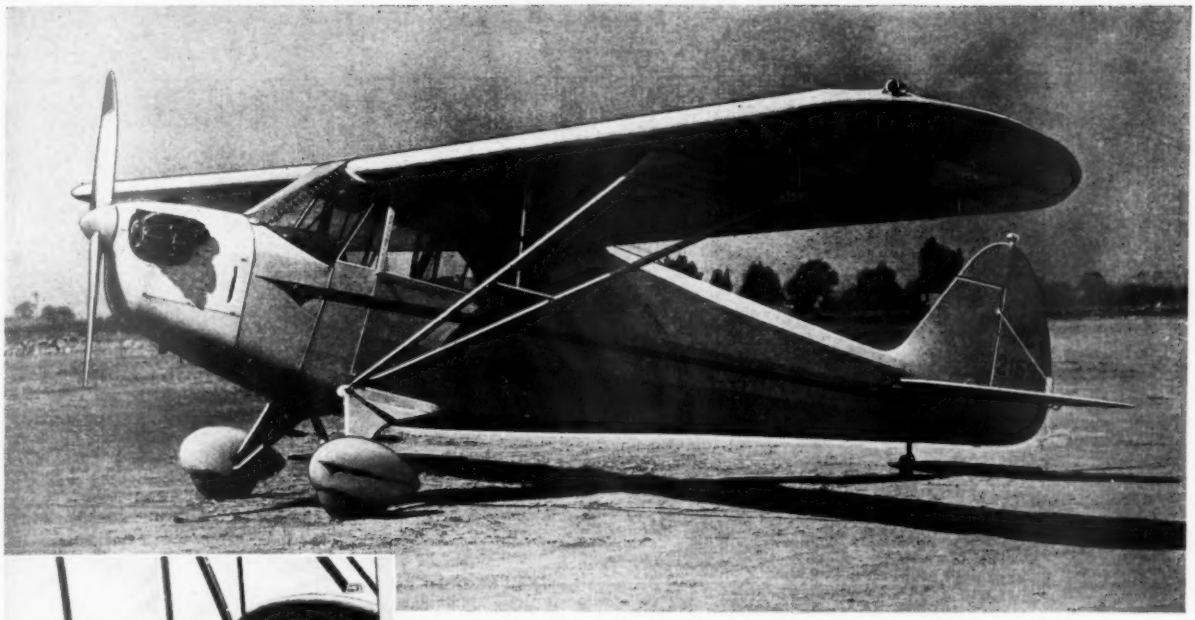
WPA Compiles Weather Atlas

STRATOSPHERE pilots of the future will have an unusual "weather atlas" which they can consult before flights. That atlas now is in the process of compilation by Works Progress Administration statisticians in New Orleans. Statisticians in the photograph above are correlating the atlas from one million weather reports.

Autogiros Fight Tree Pests



THE low-flying autogiro directly below is scouting for sections of elm forests that have contracted the dread (and incurable) Dutch elm disease. Trained observers fly in the autogiros in whatever section of the country the "windmills" are in. These observers are trained to spot the wilted or discolored foliage that indicates the presence of the disease. The observer marks the location on a map and a ground crew is sent to the scene. Only way to check the disease is to kill the diseased trees. The man at left has done this by peeling a strip of bark from the condemned tree, placing granulated copper sulphate over the exposed wood and covering it with oilcloth to keep the poison in place.



Lots of Room in this Two-Passenger Cabin

Two big six-footers are accommodated comfortably in this trim, fully upholstered cabin! Doors and steps on both sides provide easy entrance and exit. All windows slide open for ventilation. Large luggage compartment. Ample space beneath seat for batteries or radio. All controls grouped for easy manipulation and extra leg room.

For Only $425 Down You Can Get a CUB & Learn to Fly FREE!

Every purchaser of a new Cub is entitled to a free flying course, including dual flight instruction by a government licensed instructor. Get a new Cub for only $425 down and learn to fly your own plane without paying a cent for dual instruction. See the new Cubs at your dealer's and ask for a free flight demonstration...Trainer $425 down, Sport as low as $465 down, Coupe $665 down.

The Finest Light Plane Ever Built . . . the New

1939 CUB COUPE

with Side-by-Side Seating

MEET the newest member of the Cub family—the 1939 Cub Coupe! Bigger, faster, roomier and more luxurious than any other plane in its price class, it is the finest light plane ever built! And it is completely equipped. With plenty of room for two, side-by-side, this new Cub Coupe is the answer to your demand for a super-quality, low-priced, companionable ship.

Offered with the 50-horsepower engines for which it was expressly designed, the Cub Coupe handles its 1200-pound gross load easily, economically and safely—with 90 miles per hour performance. Now perfected hydraulic brakes enable the ship to be maneuvered smartly and safely in limited space. Completely streamlined landing gear minimizes wind resistance. Standard equipment includes Goodrich air wheels, hydraulic brakes, hydraulic landing gear, smart wheel pants, full-swivel tail wheel, compass, air speed indicator, navigation lights and battery, and 15-gallon tank.

No other side-by-side type plane at anywhere near its price offers such smart appearance, roomy comfort, complete equipment, splendid performance and safe, easy handling. Only $1995 F.A.F. Lock Haven, Pa.—or $665 down with easy monthly payments.

FREE!

Send today for catalog on the new Cub Coupe and other models, the free flying course and name of your Cub dealer. Paste coupon — or write your request — on penny post card, if you wish. Piper Aircraft Corp., 118 Aviation St., Lock Haven, Pa., U.S.A.... Cub Aircraft Co., Ltd., Copenhagen, Denmark and Cub Aircraft Ltd., Hamilton, Canada.

PIPER AIRCRAFT CORPORATION
118 Aviation St., Lock Haven, Pa., U.S.A.

Please send me your free catalog on the new Cub Coupe and other Cub models, full details on the free flying course and name of my Cub dealer.

NAME_____

ADDRESS_____

CITY_____ STATE_____

COUNT THE CUBS THE WORLD'S FASTEST SELLING AIRPLANE

A Metal Prop for Gas Models

(*Continued from page* 56)

viding you have trouble. Take the bumps out of the blade with medium sandpaper, using a block. Finish with a very fine sandpaper and make sure that all the under sections are flat, as shown.

Coat the finished blade with at least two coats of shellac, or dope. Sand between coats, so that the surface is fairly smooth.

This completes the pattern for your propeller. Now either take or send this pattern to some company that does aluminum casting. The original blades were cast at the Bohn Aluminum Company in Detroit, Mich. You will find that almost any big company will cast these blades at a very reasonable price. The original blades were cast at a cost of $1.70 for eight blades.

After the blades are returned to you, you have two courses of action open, regarding machining the roots. If you have access to an engine lathe, machine the circular root down to $\frac{7}{16}$", and cut the standard threads as shown in Fig. 4. If not (as is usually the case) cut off part of the root so that it is only ¾" long. With a file take off any irregularities that have resulted from casting, and chamfer the end of the root about $\frac{1}{16}$". Hold the blade in a vise and thread the root with a $\frac{7}{16}$"-20 die. This die along with die holder—if unobtainable in the shop where you work—may be bought in dime stores for about a quarter. In using the die, remember to run the die backwards every once in a while to clear the chips which have been cut. Thread the root as far down as it will go. Cut ¼" off the end of the threads, so the root is now ½" long. Follow the exact procedure for the other blade.

The blade is bound to have a poor finish after casting and, to remove irregularities, sandpaper is about the best thing to use. Take care not to use too rough sandpaper at first, as it will scratch the aluminum too deeply. Use successively lighter sandpaper, winding up with crocus cloth. To get a finish that will look like chromium plate, buff the blades lightly on a buffing wheel, being very cautious, and holding on to the blade very tightly. This finishes the propeller blades.

Hub

There are two methods of making the hub—depending, as before, on whether or not you have a metal-turning lathe, or access to one in high school or college shops.

If you have a metal-turning lathe, machine the outside of the hub to the dimensions given. Center drill the end with a D-2 or E-2 center drill, and drill about 1½" deep with a "W" drill. Put a $\frac{7}{16}$"-20 tap in the tail-stock chuck of the lathe, and turning the headstock chuck by hand, tap the hub, allowing the tap to pull the tailstock in. With a cutting-off tool, cut off the hub, and the machining is complete. The material used here may be either duralumin or steel, with duralumin greatly preferred.

If you have no lathe, make the hub by brazing together short lengths of steel tubing as shown in Fig. 2. The tubing is obtainable at very low cost from aircraft accessory dealers. The sizes are shown in the drawings. After brazing, file a flat on the side of the hub as shown in the drawing. Grip the hub in a vise and, by hand, tap the $\frac{7}{16}$"-20 thread all the way through as shown. The tap and tap wrench also can be bought for a quarter.

To drill the hub for the shaft hole, the center of the hole must first be accurately punched in the surface of the hub. If the flat has been filed—or spotfaced, if you have a drill press—the hub will not roll when placed on a flat surface. This will help punching greatly. After the center has been punched, drill in a short way with a center drill or a small drill, about ⅛". Size is immaterial. Now hold the hub in a vise and drill all the way through with a ¼" drill, using a hand drill or a portable electric drill. If you have a drill press, merely hold the hub down on the drill press table and drill through.

To cut the slit in the side of the hub, hold the hub in a vise, with the flat against one of the vise jaws, and with a very fine hacksaw, carefully cut the slit. If you are careful, and guide the hacksaw evenly and firmly, you will get a very satisfactory slit. You are now ready to assemble the propeller.

Assembling and Adjusting

Screw the blades into the hub. If the fit is not tight enough, put the hub in a vise, and squeeze the hub together ever so little. This should tighten up the blades sufficiently so that they will not float around in the hub loosely. Incidentally, it might be a good idea, only if you are using a steel hub, to run the tap through the hub again after the slit is cut. This prevents the hub from cutting into the threads on the blades.

A suggested method for checking the blade angle in adjusting the propeller is shown in Fig. 3. Construction of this device will not be discussed, since it may easily be built from the drawings without further details. Also, you may have some other idea on checking angles. Make sure, however, that the angles are exactly alike on each blade, at exactly the same radius. The convention in this country has been to check blade angles at 70 per cent of the radius, and this is perhaps the wisest thing to do for your metal propeller. Each blade should have the same angle within one-half a degree.

To balance the propeller, use a piece of very smooth $\frac{1}{16}$" brass or steel rod as a pivot. Test for balance and remove metal from root sections—that is, sections near the hub—for balancing. This detail is important, for while the blade may be perfectly balanced statically, it is not in dynamic balance, and at speeds of 4,000 r.p.m., serious vibration will be encountered.

Next, test the blades for "tracking", making sure that the tips strike exactly at the same point on a stationary reference mark. If the tips track, then the plane of the blades will be at right angles to the center of rotation, insuring axial balance.

After the propeller is balanced and polished up, set the proper blade angle with the blade angle setter. See Fig. 9 for an approximate value of the blade angle for this 15" propeller. Do not use this angle for propellers with other diameters. Set the blade angle on each blade and, taking care not to disturb its setting, slip the propeller on the shaft. Tighten up the conventional propeller nut found on nearly all small engines, again watching the blade angles to prevent changing them. If this nut is tightened up very tight without the plate that is usually used to prevent crushing wooden hubs, the hub of the metal propeller will be squeezed together sufficiently to hold the blades in place quite firmly. Make very sure that the nut is as tight as you can get it, or the propeller will slip.

It is a good idea to use a glove when flipping over one of these propellers. There have been no accidents to date, but a glove on the right hand is not inconvenient, and the author often uses one with wood props. "Safety first" is a good motto always, but especially so with gas models, for there are people who would be quick to use any accident as an example of the "danger" of gas models.

END

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DECEMBER ISSUE of
POPULAR AVIATION
On Sale November 8

The Future of Our Air Force

(*Continued from page 44*)

forces go into action. This last looks pretty hopeless.

The present setup of anti-aircraft in this country is entirely inadequate and appears to be mechanically inefficient. The recent "blackout" of Farmingdale, L. I., during the air force maneuvers, apparently indicated that the crack anti-aircraft regiment of the Army—the Sixty-Second Coast Artillery—would be nearly helpless in a real air attack.

It was reported that they failed completely to locate the ships that did the "real" bombing in the "blackout," that the best they could do was pick out with their searchlights, and theoretically shoot down, those bombers that dropped flares to flight the targets for their high-flying comrades!

There are not enough anti-aircraft guns in the entire United States to defend New York City alone, Army officers admit, and no gun of this type is said to be really efficient. In addition, it is reported reliably that this country has a silencer for airplane engines that completely destroys the efficiency of the existing sound detectors. What this country has, other nations also must have—especially Germany, which always has led the world in fire control devices and other such necessities.

This must not be construed as a criticism of the Coast Artillery, which has been entrusted with a major portion of the anti-aircraft activities of the Army. Very little help has been granted the corps by the government in recent years, especially since President Roosevelt, who apparently realizes that he can't fish from an anti-aircraft gun or a bomber, has been in office. The artillerymen have done the best they could with the limited equipment and money available, but that equipment isn't enough and more money is needed.

But in the meantime, in the absence of anti-aircraft equipment stationed within the vicinity of all aircraft factories and other industries vital to the naional defense, it has been suggested that the alternative measure of screening the objectives from sight might be adopted.

Provided some warning were given, even the detonation of the first few bombs, this could be done with reasonable efficiency at a fairly low cost. Some form of smoke or heavy, long-lasting and harmless gas could be spread around all potential objectives through a system that would go into action with the first alarm.

This method has been considered favorably because of several first-class examples of its efficiency. Army airmen flying in California, for instance, have found that the smudge pots used to fight off frost in the fruit areas have completed blanketed those sections, making potential targets invisible. The curtain of fog and smoke that often hangs over Pittsburgh is an innocent, but nonetheless effective, defense weapon.

Summing up all these factors in the problem of defending the United States points to the decision which most authorities seem to believe confronts those responsible for our defense by air from invasion. This decision, they think, will be the formation of a separate air force.

Make no mistake; no one is advocating an abandonment of the Navy or the Army, both of which always will remain a vital portion of our armed forces.

The country getting the overwhelming air supremacy will win the war. It would have to win it. But there is always the possibility that the opposing airplanes will raid each others' country until the aircraft and factories of both will be destroyed. Neither side would then have airplanes left to carry on a long distance war, and the Army and Navy would have to step into the breach.

Nor would each service be isolated and aloof from the other two. The air force would retain a close connection with the two older branches. There would be always personnel and airplanes assigned to the senior services. There would be pilots manning observation planes to spot enemy targets for the surface vessels and the Army's guns, provided those targets got within their range. There would be pursuit planes assigned the job of intercepting bombers attacking our battleships and other surface vessels.

The battleship, as Hanson Baldwin, the New York *Times'* military affairs expert, says, always will be with us—at least for a long time to come. On the other hand, another expensive surface vessel, the aircraft carrier, seems to be practically out of the picture.

The carrier has just one purpose, and that is to ferry warplanes within cruising range of their targets. Until the *Flying Fortress* came into the picture, it was a necessary piece of equipment. Within five years, it will be a useless expense. The 10,000-mile cruising range of the coming bomber will make such a ship, which is probably the most vulnerable of surface craft to air attack, an obsolete target.

Naval authorities will argue this point both ways. Nonetheless, it is just plain "hoss sense" to say that the aircraft carrier makes an ideal target for a high-flying bomber. One high explosive bomb on the flight deck would eliminate the threat of retaliation from the carrier's fighters. The rest should be comparatively simple.

If the aggressor nations know that we have bombers perfectly capable of flying across either ocean and blasting their industries, and that we have the means to protect our own, then possibly they will leave us alone, as we want to be left alone.

In any event, the separate air force is as certain to come, now that changes of such vital nature have developed, as night follows day. It will have to come. Either it must, or we might as well stop spending too-scarce money on any weapons at all, and hope for the best.

END

The Birdmen's Perch

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Mgr. Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

NEW BUSINESS DEPT.

We're thinking about inaugurating a new feature: a sort of monthly Aviation Quiz to cover anything from the names of five planes beginning with Z to What's the best thing to do if your motor drops out at 20,000 feet?

But, first, let's have your comments with a few suggestions as to suitable questions. Don't let us down. Give us permission to use your name and we'll give you a credit line. *No foolin'!*

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You have 40 gallons of Gulf Aviation Gas (advt.). You want to be able to measure any number of gallons from one to forty. The only way you can do it is by pouring it into cans. Which, by the way, may be any size.

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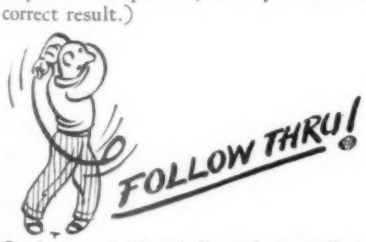
(Mail your answer to T.W.T. You'll be surprised and pleased, probably more surprised than pleased, when you see the correct result.)



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THIS MONTH'S WHOPPER

Dear Major:

Well, sir, last week I was cruisin' on my little boat, The Question—(her full name "Yawl Ketch Any Fish?")—when I seen an airyplane bobbin' up and down on the water. "Hey" hollers the pilot, "where's the nearest landfall?"

Well, sir, I couldn't resist that one. "What do you want a landfall for?," I yelled. "You've done made a waterfall!"

But he didn't laugh none. "I'm outta gas," he says, nasty-like. "You got any?"

"No gas here," I comes back. "This thing runs on wind."

"So does this!" he snaps, "but it takes gas to start it! . . . Where am I, anyway? Can't be the Missouri 'cause I don't see no mud!"

"It's the Missouri, O.K." I tells him. "But she's growed a little. This yere's the Gulf of Mexico."

"Quit your kiddin'" he says, suspicious-like. "I don't hear no Spanish Music. Besides all this palaver ain't gettin' me no gas."

Then he sort of snapped his fingers and clomb out on the wing. I thought she was sinkin', but no! By grannies, he began to pat that engine and talk to her. And dang my binnacle's barnacles if it didn't bust out into a roar!

"How'd that happen?" I hollers.

"Well," says he, throttlin' her down, "you told me where I was and that was enough. I just whispered into her ears. 'Honey, this is the Gulf . . . this is the Gulf'. That's all she needed. Just mention the word Gulf to a plane engine and she feels like a kid. They ain't nothing like Gulf Aviation Gas, sailor. Honest, they run better on the thought of Gulf Aviation Gas than on some stuff out'n a pump."

And dang my rudder post, if he didn't take that thing offen the water and buzz outta sight! That's why I'm gettin' a motor for The Question, stranger. I wanta burn that Gulf Aviation Gas, too.

R. H. Wade

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Spies? Phooey!

(Continued from page 58)

what engine it used and how much weight (or the number in the crew) it was designed to carry. By that I mean he could copy the plane to the *nth* degree and make it perform to the same figures of the original. It might not be exact in actual structure, but what would be the difference? It would fly the same, carry the same load and perform the same duty.

"How?" you might ask.

"Easy," I reply with my peculiar vintage of *sang froid*. "All the engineer has to know is the measurement of one item, and working from the photograph, which he would have greatly enlarged; he could work out the rest of the measurements."

If he knew, for instance, that the cowling covered a certain type of engine, he would know that that engine weighed so much and had an overall length of so much. He could check further with a wheel or variable-pitch prop blade, and he'd be in clover.

Or am I giving away some of the secrets of the Amalgamated Order of Aircraft Spies?

The British who are not supposed to have a sense of humor, make it easy. Regularly every week, the London aeronautical publications *Flight* and *The Aeroplane* present complete, detailed drawings and photographs of all their latest service ships. The other day they came out with what amounted to reproduced blue-prints of the Hawker *Hurricane*—but of course the *Hurricane* only does 360 top (official) and she only carries eight guns, so she's probably only a primary trainer about to become obsolete.

The spies in Britain must have a hell of a time figuring out whether they are being kidded or just being saved a lot of trouble. The British, on the other hand, probably find out that this keeps the gangways and production lines clear of silly mugs who would otherwise be in the way.

But maybe the spies are trying to find out about the anti-aircraft business in this country. If they are we feel sorry for them, for according to official reports, there aren't enough guns in the country to protect the city of New York, let alone the Pacific Coast.

Why waste time snooping all over the country trying to find out about the anti-aircraft defenses when the New York *Times* of June 23rd came out with more than a column explaining in detail the latest anti-aircraft measures to be adopted, the guns that were to be used and in some detail the features of the latest 75 mm. and 105 mm. anti-aircraft guns?

Or am I the only guy who reads the papers?

Anyway, there it was, carefully published on the front page, straight from Washington, including the addresses of the factories that will make the guns and

(Continued on page 76)

Airy Chat

(Continued from page 8)

INCOMBUSTIBLE gasoline is not a new idea as a safety measure for airplane operation, but so far it has not proved practicable for a number of reasons. This gasoline, which is an inert incombustible liquid in the tanks or open air, loses its pacific nature when it enters the cylinders of the engine, thereupon igniting and acting just like the present day gasoline.

Several gasolines of this type were produced experimentally in France several years ago, but were not marketed because of certain objectionable features that reacted from a commercial standpoint. However, we now hear more favorable reports from a group of American scientists who have materially improved the liquid and, what is more, have produced it cheaply by new process of distillation.

Incombustible gasoline is a ten million dollar idea that will not only save lives and property but will also increase the popularity of air-travel, just as the substitution of helium for hydrogen safeguarded the dirigible and balloon.

* * *

WHEN screw propellers are employed with an airplane, the wings give the power plant a mechanical advantage in sustaining the weight of the machine in much the same way that high pressures can be created with relatively small applied forces by means of a wedge. In short, the airplane wing allows a relatively small horizontal thrust by the propeller to lift a heavy load by acting as an inclined plane in which the force generated by the powerplant in a horizontal direction is multiplied many times by reducing the rate of climb.

In the case of the helicopter, the thrust of the propellers acts directly upon the weight of the machine without the multiplying advantage of the inclined plane. This means that a much greater proportion of the power must be converted into static thrust than is usual with the airplane and this introduces many more problems into the engineering end of the design of a helicopter.

* * *

JUST here, I wish to remark upon the constant attention that is being showered upon propeller design while other factors requiring greater attention are being politely ignored by our engineers. The mechanical efficiency of the airplane propeller, even in its primitive form, is surprisingly high and the most drastic and radical improvements can only add a few percent to the efficiency of the helical blades.

It calls to mind the remark by Prof. Thurston many years ago to the effect that "anything that looks like a propeller has an efficiency of at least 70 percent." Of course, there are other important factors to consider aside from the matter of power conservation, but as a whole, these points are rather in the background when the subject of propeller merit is discussed. END

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Sept. . . .	20	17	7
Oct. . . .	4	3	2
Nov. . . .	2	2	2
Dec. . . .	29	7	3
1938			
Jan. . . .	7	14	6
Feb. . . .	1	9	7
Mar. . . .	40	16	6
Apr. . . .	6	13	3
May . . .	6	12	6
June . . .	30	5	4
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Do You Know . . .

. . . THAT flying in the same Wright Cyclone-powered Lockheed 14 in which he circled the globe in the record time of 3 days and 19 hours, Howard Hughes recently flew from Los Angeles to New York in 10 hours and 33 minutes.

. . . THAT the purpose of the Hughes flight was to test a new type oxygen gas mask developed by Dr. W. R. Lovelace and other physicians of the Mayo Clinic at Rochester, Minnesota for high altitude flying. And that the famous Lockheed 14 is enabled to fly at higher altitudes by the newly developed Wright Two-Speed Supercharger with which each of its two 1100 H.P. Wright Cyclones is equipped.

. . . THAT Two-Speed Supercharging produces in effect "two engines in one" by making the best power available both at sea level and at high altitudes.

. . . THAT besides the Wright Two-Speed Supercharger, another recent engineering development released for export, and exclusive with Wright Cyclones, is the non-icing carburetor. That this carburetor guarantees an even gas flow in the coldest flying weather as well as automatically adjusting the fuel mixture to variations in flying altitudes.

. . . THAT the U. S. Navy recently placed a large order for Curtiss SBC—4 Scout-Bombing planes, all powered by Wright Cyclone engines. Planes of this type are the standard Scout-Bombers of the United States Navy.

. . . THAT the U. S. Navy recently placed an order with Brewster Aeronautical Corporation for 54 powerful Brewster F2A-1 Fighters powered by Wright Cyclones.

. . . THAT Wright Cyclones also power the Brewster Model 138 two-place fighting and bombing plane which is now available for export.

"Fly with Wright the World Over"

WRIGHT
AERONAUTICAL CORPORATION
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Winged Fire Fighter

(*Continued from page 28*)

amplifier to talk to people who may gather on picnics, at camps, or in other groups in the forests, and to hunters, warning of the dangers of not obeying fire prevention laws.

It is expected the voice amplifier will be especially beneficial in broadcasting warning information to people in fire danger zones and in giving direction to forest service men in areas where they have no radio facilities.

The fourth line of investigation by the laboratory plane will be further work on the laying down of supplies on fire lines and in remote camps. POPULAR AVIATION recently covered this phase of the use of airplanes by the Forest Service. Regional Forester Show reports there is still considerable experimental work to be done on this phase, even though it is being used to a major advantage in fire control work today.

The development of satisfactory parachutes is the major problem. It is necessary to develop a parachute which will drop the supplies at a rate of speed not faster than 30 feet a second to insure safe landing of all types of supplies. Certain technique in packing supplies and in approaching the target must also be perfected.

The new Stinson is equipped with two-way radio for contact with Forest Service field sets at fire camps and national forest headquarters.

Regional Forester Show points out that the use of private airplanes for actual fire fighting work will not be replaced by the new plane.

The major portion of fire control work by plane will still be carried on by privately-owned planes contracted for by the Forest Service. The findings of the flying laboratory will be adapted to the contracted planes.

The importance of the plane control work is seen in the early fire record in California this year. The early control of more than 500 fires which burned in national forests of California during the later part of July and early August was due in part to the use of six privately-owned planes carrying food, equipment and supervisory personnel to the fire lines, and the radioing of fire fighting directions from a position where every aspect of the fire could be seen.

END

Spies? Phooey!

(*Continued from page 74*)

the gun carriages. There it stated, after considerable type had been used to explain them, that "the guns were still an Army secret" but the article also added: "The American 75 millimeter anti-aircraft gun is not excelled by any similar gun in any army, the experts believe."

I am one of those dumb people who might ask: "How do you know, if they have never fired at anything? How do they know if they have only tested it at the Aberdeen proving grounds? And if so, why tell the enemy spies?"

But the best line in the *Times* article for the information of the enemy spies was this:

"In the event of an emergency, no private plant would be able to begin production of anti-aircraft guns and equipment for a year, if not longer, Army data show."

Then there is the new "secret" cupcake fuselage system now under close guard at Wright Field. Here again enemy spies are being rudely shoved around so that they cannot find out how plastic molds are being made, bolted together and put under severe static tests, in hopes that the idea will provide a high-speed system of turning out warplanes.

There's one for the book! Doesn't the Army know that Lockheed was doing that years ago? Don't they know that the old *Vega* was nothing but a spruce veneer shell in two halves, formed to shape and glued under pressure?

Oh, but this is something new, eh? I say it's bakelite and the hell with it!

What's the difference what you press it out of; the idea is nothing new. They've all been playing around with so-called plastics for years. Or am I breaking up a beautiful old tradition? Tony Fokker has been using bakelite wings for years! How much bakelite is there in the modern American glider?

On second thought, what would we do without these spy stories? About 2000 "thriller" story writers like myself would soon be on the beach.

Of course there is something behind it all. The Federal Government is not pinching hairdressers off ocean liners just to kill a little time. There are spies in the racket somewhere, but they are not simply swiping aircraft "secrets".

Frankly, I don't know what it is, but I'm glad to know they are nabbing them now, before anything happens. For putting your hooks on a spy in war time is a much tougher proposition than it is when they are not so keen and simply picking up oddments to make a questionable living.

The wartime spy is risking his life, for death is the penalty of being caught. He usually knows what he is after, and he has more money to spend in getting it. If we can discourage him *now* it will be much easier if and when the guns begin to boom.

But I do wish they would get a new one and let the military plane "secret" gag die down, for there are none—really.

END

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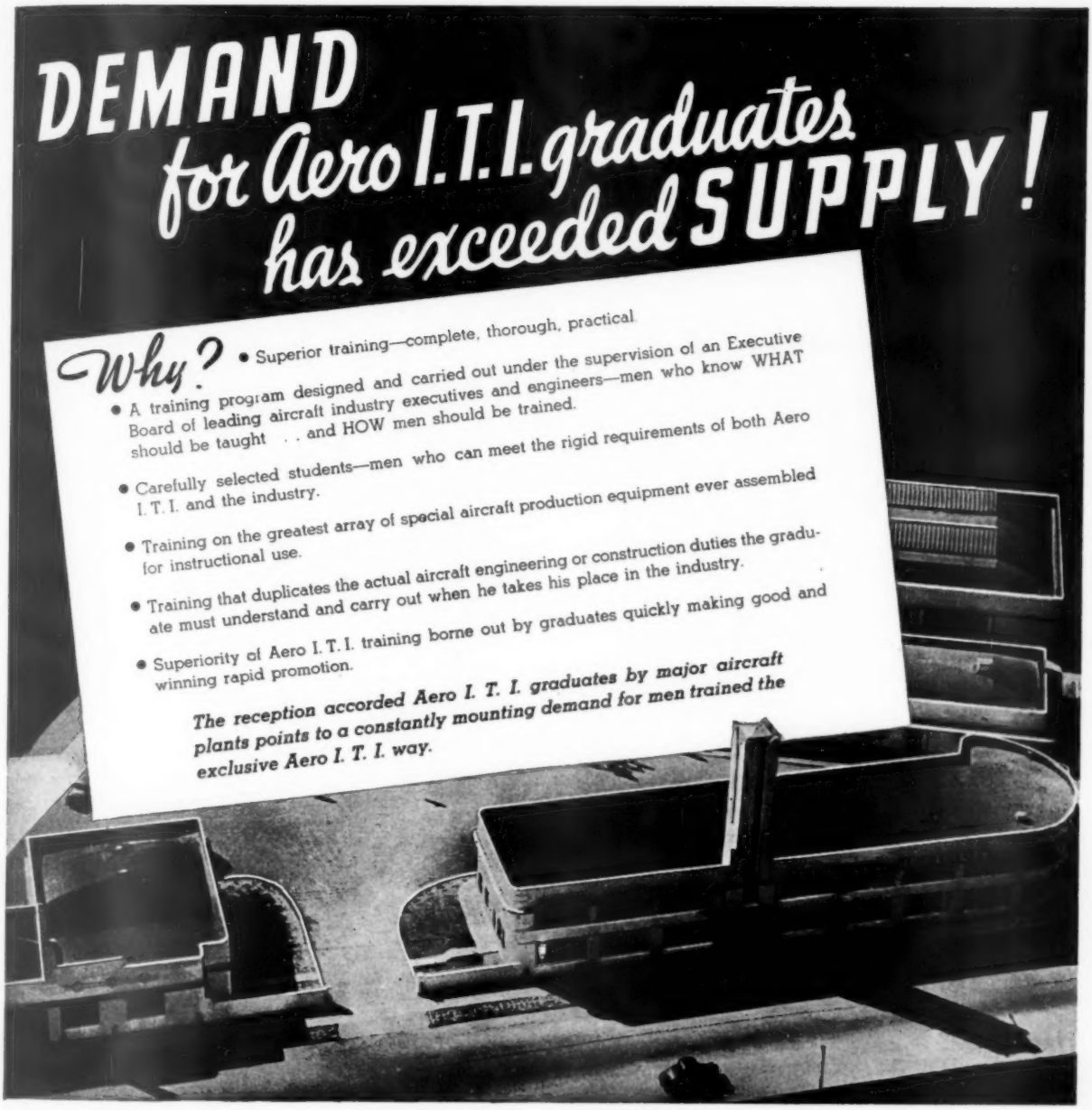

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Flying Scoops

(*Continued from page 42*)

of the piled up cars and locomotive. But luck was with the airmen. They found a suitable field within 200 feet of the wreck and landed in only five inches of snow.

Bill not only got his aerial views, but intimate ground pictures as well. He was far too pleased over the happy combination to complain about floundering through drifts up to his armpits.

The name "Scoop" is intended as it would seem to be defined. It means that *The Pantagraph* usually has the jump on all its central Illinois competitors because it alone operates an airplane. The name was selected in a contest in which 1,200 suggested designations were submitted.

Scoop II also was flown to victory in the 1929 National Air Races by John Livingston of Aurora. To Davis Merwin, former publisher of *The Pantagraph*, goes the credit for not only promoting aviation's interests in central Illinois, but for making that section of the state "air-minded" back in 1929. A pilot himself, he was among the first to discern the enormous advantages to "spot" news coverage through utilizing the airplane. Then, when it was found that the propeller blast interfered seriously with the operation of ordinary newspaper cameras, a special aerial camera was purchased in 1930.

Good pictures had been obtained before that, though, for Scoop I, the first Waco hurried aloft to the distinction of meeting the *Graf Zeppelin* on its world flight and enabled *Pantagraph* readers to see pictures of the airship in actual flight over Illinois.

When the original Bloomington airport north of the city—a 72 acre tract—became obsolete in 1932 because of its size, businessmen of the city contributed $25,000 with which to purchase the present 164-acre municipal field east of the city on State Route 9. It was a non-speculative plan of making the land available to the city under lease with option to purchase. The city subsequently leased the port and is in charge of its operation.

END

Gas Model

(*Continued from page 63*)

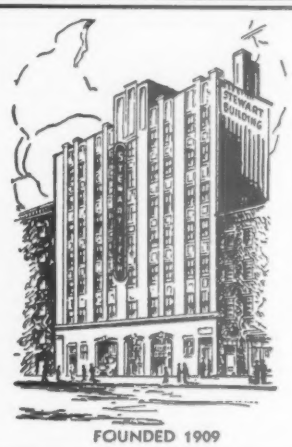
builder as being an unworthy piece of construction. In covering the fuselage it is best to cover it in long narrow strips from front to rear. Smooth down any rough edges with dope used in attaching bamboo paper to framework. Incidentally, dope used for attaching the paper is ordinarily model airplane cement cut with about 25 per cent 30 per cent thinner. Covering the wings is a much simpler job than the body, but make sure that the paper is cemented to every rib on the under surface so as to keep the curved section when paper is shrunk. The paper on the top side of wing panel may be only fastened to every fourth rib or so. When applying the water to the paper parts, make sure they are held securely in position by means of blocks to prevent them from warping out of shape. After all these parts have become thoroughly dry, two or three coats of model airplane dope are given them with a light sanding before each coat. The colors are next applied.

Before making the flying test, check the model for alignment and for the security of the various parts. Tighten all parts that may have been loosened by the shrinkage of the covering and check propeller fastenings.

Testing and Flying the Model

This should be done preferably over tall grass or weeds so as to prevent any injury to the model. Adjust batteries so that when model is held by fingers from either wing tip one-third of the way back from leading edge, it will balance with the nose pointing down about one or two degrees. Next launch the model from the hands into the tall grass or weeds so that you may determine whether it glides to the ground without stalling or diving. If either of the two should occur, move the battery on the rack to correct for it. When testing the model under power, the throttle should not be completely opened until you are thoroughly familiar with the ship's behavior. A few trial flights will acquaint you with its different maneuvers.

END



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Flying Battleships

(Continued from page 52)

appears best suited to the Navy's needs.

The awarding of that contract will mean exultation to the successful bidder, and bitter disappointment to the loser. For both Consolidated and Sikorsky have concentrated their greatest efforts since 1935 in the development of this military plane of the future.

In competition with other aircraft manufacturers, these concerns won experimental contracts granted by the Bureau on the basis of preliminary designs.

Before the finished product left the final assembly shops, the producers had spent a lot more than the Navy had given them in the original contracts.

For instance, Consolidated received $600,000 from the Navy. But, if another $400,000 had not been added by the company, its bomber would never have been completed.

The two airboats are similar in many respects, radically different in others. The motive power for both is exactly alike. Each has four 1,050 h.p. Pratt & Whitney *Twin Wasp* engines. They are all-metal, high wing, full cantilever types. Machine gun turrets in the bow, the tail and in the center of the hull afford protection on all sides—at a moment's notice, the air in a complete circle around the planes could be sprayed with death-dealing lead.

Both have 110-volt electrical systems —an innovation in military airboat construction—which generate power for the radio, anchor winch, lighting system, bomb controls, and miscellaneous electrical appliances, such as those in the galley. Electrical current on flying boats previously has been supplied through a 12-volt direct current system.

Complete telephone hookups are installed, enabling crew members to speak to each other from any point of the planes, bow to extreme tail.

The radio equipment, placed in a separate compartment, is comparable to that on a destroyer. Commodious living accommodations are provided the crew—what with a galley that would satisfy the most exacting housewife, water distiller, refrigerator, clothes lockers, toilet and washing facilities, heating and ventilating system, soundproofing, and even a completely equipped mechanic's workshop.

The non-stop range of each has not been officially disclosed, but it is believed to be about 1,000 miles greater than the Navy's PBY airboats which have made seven successful delivery flights—involving 99 bombers—from San Diego to the Canal Zone and Pearl Harbor, Hawaii. That would give the experimental "air battleships" a potential cruising radius of about 5,000 miles without refuelling. This in itself is a startling fact. For instance, if Hawaii suddenly was threatened with aggression, a fleet of four-motored bombers could take off from Pearl Harbor, roar defiantly 2,500 miles to sea, drop their heavy "eggs" and return for another load—all without alighting!

In effect, Uncle Sam's new aerial defenders have overnight further extended by hundreds of miles his defense frontier, already a great distance from the shores of this country and its possessions.

In two important respects, Consolidated's XPB2Y-1 and Sikorsky's XPBS-1 are strikingly dissimilar. The tail and the wing floats of each airboat are widely different in design.

When Consolidated's bomber was launched last December, its tail was of the usual construction—with single rudder in the center. In its first trial flights, the plane's performance did not measure up to the "on-paper" expectations. To gain more directional stability, two small fins were installed, one on each side of the rudder. But this experiment proved a failure, and Consolidated and Navy engineers finally decided that the solution meant scrapping of the whole tail and the evolving of a new design. *(Boeing made the same mistake with its new Pan American Clipper.—Ed.)*

This creation has become popularly known as the "twin tail" and consists of two circular rudders at the end of stabilizers which meet at a seven-degree dihedral angle instead of lying horizontally.

The single rudder of the Sikorsky airboat apparently has functioned satisfactorily.

Unlike the Sikorsky wing float, the Consolidated plane's pontoons are retractable and fold back to form the wing tips during flight. This characteristic is present also in the twin-engined PBY's.

Failure to secure a production contract on the four-motored bomber will not spell complete loss to the unsuccessful

bidder. Both planes have great commercial possibilities.

Maj. Reuben H. Fleet, president of Consolidated, has, for example, pointed out that the XPB2Y-1 could easily be converted into a transatlantic passenger plane, carrying 30 passengers and six crew members in luxurious comfort. And on shorter trips, the graceful hull would have a 50-passenger capacity.

The Sikorsky XPBS-1 weighs five to six tons more than its previous commercial flying boats and represents a marked advancement in design, especially in the full cantilever wings flush with the top deck. The older-type Sikorskys have the wing placed up and above the hull, and kept secure by semi-cantilever strut bracing, allowing for a far less streamlined effect. It takes little stretch of the imagination to place this ship in the forefront of the famous Sikorsky transoceanic clippers.

A jealously kept secret of the Navy is the bomb and torpedo-carrying capacity of the giant airboats. The Navy Department has issued a general statement to the effect that the planes will be able to carry a "tremendous load of bombs", comparable "with that of any known existing airplane". To one acquainted with military understatement, especially in confidential and experimental matters, such an admission by the Navy Department carries little but forebodings to potential enemies.

Still more hushed are such facts as the speed with which these mighty new wings will be able to beat through the air. It is known for a fact, however, that the cruising speed of the bombers, even with capacity loads, will be in excess of 150 m.p.h., and top speed is expected to be more than 200 m.p.h.

Dimensions are more easily obtainable. The Consolidated airboat, for example, has a wing spread of 115 feet, only 11 feet more than its twin-engined PBY predecessors; an over-all length of 80 feet, and height, when raised on the beach landing gear, of 22 feet.

When these sharp-clawed eagles join the Navy's air forces, a virtually impenetrable network of sky patrols will bulwark the national defense along a hypothetical "fence" thousands of miles to sea.

Already at Hawaii are 59 of the new two-motored long-range PBY's, delivered in four spectacular non-stop flights from San Diego. At the Canal Zone are 40 of these airboats. Defending Puget Sound and Alaska are 12 more, reinforced by 18 of the P2Y craft, an older but still efficient Navy patrol plane. At North Island in San Diego harbor are 48 ready to dash out on their grim task of protecting the west coast from surprise attack. By the end of this year, more than 200 will be in the service of the Navy.

And when their roar is augmented by the deep rumble of four-engined "battleships of the air", the nation can rest assured that not even the wiliest tactician could hope to slip past the imaginary battlements patrolled by these sentinels 2,500 miles from shore.

END

Barnstorming

(*Continued from page* 38)

rience and 15,000 flying hours, and the size of the ships make good copy.

"But the barnstorming business isn't all a bed of roses," said Chamberlin, pointing out the high cost of his operations. The ships use 100 gallons of gasoline and two gallons of oil per hour; the airports they use usually get 10 per cent of the income, but the overhauls really hurt. Tires cost $285 each and a set of two lasts a year; a crankshaft for one of the two engines costs about $1,200 and an engine block $1,500.

The ships get regular overhauls and propeller etching every 2,000 hours.

His biggest run of business?

"Well, once I made 12 flights in an hour, with a full load of 27 each trip," he said, "which means over 300 persons, and I've often had 200 or 300 persons lined up, waiting their turn."

But the outlook for his business is quite gloomy, Chamberlin believes.

"When these ships are gone," he said, "so is the barnstorming business—except for that with the big flying boats; for the new transport ships won't do the work. They're too fast."

But already Chamberlin is prepared for that day, with a 36-place Consolidated *Commodore* flying boat.

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Pilots' Godfather

(*Continued from page* 31)

shoulder with a slow directness and evidence of conviction that are worth yards of flowery oratory.

It is this faith in his beliefs that make the man what he is. He is so certain that the amateurs are entitled to better treatment that he is unable to understand why others do not feel as he does. Unlike most of us, he puts his faith to practice. As this is being written, the Oregon law is slated to come to a direct test of strength with the Bureau of Air Commerce. That certainly should cause anybody to stop and ponder a while, but not Charlie Bernard. At this moment he is rushing work on four new hangars, certainly a heroic way of showing his faith in American justice and of keeping up the morale of the worried amateurs. The action is all the more noteworthy because he stands to take a disastrous loss in case the Washington juggernaut is able to squelch Oregon's flying freedom. Not only that, but he is to a certain extent risking the futures of his wife and three children on the theory that Right is Right and must prevail.

It is not too much to say that Oregon by this time would not have any amateur flying interest had it not been for Charles Bernard. He supplied the needed opportunity and encouragement that has kept it alive and growing. If every town and city in these United States had a Charles Bernard the story of private flying would be much different than it is today.

END

Florida

(*Continued from page* 36)

and smaller communities, and everywhere we were royally welcomed and entertained. The 1936 tour proved so popular that its interest penetrated to the Gulf Oil Corporation, and this past summer when we announced our second annual tour, the Gulf Oil Corporation donated all of our gas and oil used on the cruise.

"Besides these activities we are always pushing aviation education and promotion, the build-up, not only of fields but of pilots and of industries. We want and expect our Florida people to be thoroughly air-minded, and I think we are accomplishing just that."

While various governmental agencies have helped Florida popularize aviation, a great deal of the credit must go to the men themselves, such as G. Wayne Gray. A very busy man, he nevertheless seems to find time to promote the interests of aviation in Florida. Men of this sort do not have a superficial interest in aviation, their interest and enthusiasm is of the same sort a technical man cherishes for his profession. Perhaps that is the more important reason why Florida can lay claim to being the nation's most air-minded state. Black and white figures in a recent survey indicate that Florida is now tied for second place with Texas in number of airports in the United States, with 125 in number, second only to California's 181. It must be taken into consideration, however, that both Texas and California have areas, populations and industrial wealth nearly *four times greater* than Florida. From this it would seem that aviation *is* popular in this state.

What do other important figures in aviation think about Florida's progress? Roger Wolfe Kahn, scion of the family of international bankers and who each year flies his Lockheed *Electra* to Florida, says:

"You know my interest is genuine in the possibility of aviation expansion in Florida. This state is the logical place for manufacturers of leading aircraft companies, due to unique facilities for manufacture and export. Ideal weather conditions combined with vast number of excellent airports and short distances between picturesque points make Florida second to none from standpoint of private flying."

Grove Webster, new Civil Aeronautics Authority official, recently remarked: "Florida's proximity to South American markets, climate suited to all-year activity and excellent development of airport facilities places her in a most promising position for establishment of aviation manufacturing and greatly increased private flying activity."

The National Aeronautic Association in Washington, D. C., commented: "Florida has so much to offer in an aviation way to Florida citizens and also to the aviation industry and the private flyers of the nation. Everyone is watching the Nilson plan."

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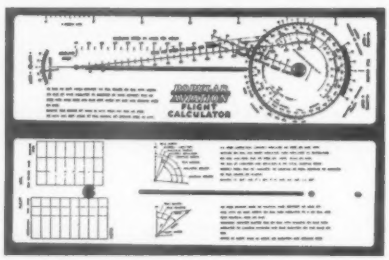

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popularize aviation in Florida—one which will no doubt lead to the greatest thrust forward in the private aviation field—is the Nilson Commercial Operator's Plan, originated by Lt. E. C. Nilson, vice-president of the Florida Aviation Association. It is a plan which is designed to bring aviation to all the small cities and towns of Florida, and some day, perhaps, throughout the United States.

The plan originated by Lieutenant Nilson involves the arrangement on the part of the Florida organization together with these small towns, to provide for them and their port, under a reasonable agreement and plan, a capable and recommended operator, with a ship, who would be placed on the port for all commercial operations, including student instruction. The general plan calls for 50 such operator units to be worked out and placed in use at as many small towns and sections as will accept and work on the idea, as a beginning. Aviation development in the section thus promoted is bound to occur. As the proposal succeeds, another unit will be commenced, of perhaps a like number; before many months have elapsed Florida will witness one of the greatest forward movements in strictly private aviation it has ever experienced, leading as it will to more pilots, the purchase of more ships, and the operation of more of them for private and business purposes and for sport and pleasure.

Such a plan will not only benefit the small communities who utilize it, but it will bring about the creation of a greater goodwill between private aviation and commercial airlines. This in turn will tend to draw such interests closer together by spreading aviation interest, thus forecasting the purchase of hundreds of new airline tickets from a source yet untouched. The operator of these local fields will at the same time be a means of furnishing a "feeder," in case of need and emergency, to the airline ports.

Nearly all of the leading aircraft manufacturers have enthusiastically endorsed this plan. They have gone even further than mere interest, many of them have offered substantial reductions on plane prices to the first communities to put the commercial operator plan into practice. Of course, it is understood by agreement that the city cannot sell the plane thus purchased for private use within twelve months after date of purchase.

This new plan is expected to accomplish even more than its first objective of having more planes in use; it will bring into the State Aviation Association a large number of small city representatives, in turn backed by groups at home, who, upon entering into the Operator Plan, are going to watch carefully any movement or legislation that will tend to damage or destroy this new growth and industry in their respective communities. Such a plan will bring a closer cooperation between the general public, the commercial airlines and operators and the private flyer, and after all, it is just another way of making aviation more popular.

Clearwater, Florida, and several other cities in the state are now working on the commercial operator plan, and before long many more Florida towns and communities will be able to boast of "air transportation and airport facilities."

When the Commercial Operator's Plan was explained before the recent Southeastern Aviation Conference, it brought a barrage of questions and requests for full information from other southern states which will eventually adopt this plan. Inquiries continue to pour in from all sections of the country, as far away as California. In effect, this points the way to a new development in aviation for the masses. During the next two years as aviation continues to advance by its usefulness and pleasure, popularity will still play the most important part in its success. Florida is the logical headquarters for students and private pilots and, in the course of time, it is expected to be the all season rendezvous of aviation. Florida has shown, in a rather remarkable way that when the masses are genuinely enthused about aviation, its popularity can make this state the most air conscious of all states in the union.

END

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Donald Douglas

(*Continued from page* 13)

discouraged Douglas chanced to tell his plight to Henry. Air-minded himself, but in the financial condition of most newshawks, Henry couldn't put Douglas and the Navy's plans on a firm backing. However, he did get the builder an introduction to Harry Chandler, boss of the *Times*.

The publishing magnate learned that all Douglas needed was a mere $15,000 to carry him until the government payments started coming in. Cautiously Chandler agreed to sign a note, if nine other business men would also put up $1500 apiece. If the venture turned out to be a flop, none of the backers would suffer an appreciable loss. Armed with Chandler's letter to this effect, Douglas soon had the necessary signatures which enabled him to borrow $15,000 from a bank. The *Cloudsters* became a reality!

With the Navy order filled the Davis-Douglas company was dissolved and in its place was the Douglas Company, capitalized at $100,000. An abandoned motion picture studio in Santa Monica was leased and here Douglas built the ships that made his brain children world famous, the DWC type planes in which the Army in 1924 circled the world. Today the Douglas slogan is "First Around the World."

At the age of 32 Donald Douglas had won a firm place among aviation's leading producers. His company grew from an original dozen employees to half a thousand in 1928 when the lease on the old studio expired. Then a new plant was built, a plant that since then has expanded many times, a factory that today has 8,000 workers, covers approximately 1,000,000 square feet and pays out nearly a $1,000,000 a month in wages. From absolutely nothing in the material sense in 1921 to the largest airplane factory in the world, that is the almost unbelievable accomplishment of Donald Douglas!

Among the ships built by Douglas have been highly successful models for the Army, Navy, and Coast Guard. His dream of commercial ships is now an every day proposition as Douglas liners are used on most of the airlines in this country and in 22 foreign countries. On every continent the name Douglas is carried on sleek, metal sky-birds.

Donald Douglas himself, the man who, for the first seven years he operated his company put all his earnings back into the business, is absolutly unlike the fire-eating, drum-beating, go-gettum, type business man. He is quiet and clothed with dignity while he is at his office which, incidentally is large, but not overly elaborate and on the walls of which pictures of racing sailboats vie with those of Douglas sky hawks.

Frankly the worst thing about Douglas to a newspaperman, or an interviewer, is that he is difficult to "cover." Not that he isn't pleasant, but he won't talk about himself as freely as the writer would like. Perhaps he is publicity shy. He'll

converse about "shoes and ships and sealing wax" and even "cabbages and kings," but Donald Douglas wants to keep Donald Douglas in the background.

His business philosophy is "a fair wage to labor, a fair profit to capital." His only major labor trouble was last year when the CIO Automobile Workers tied up the plant with a widely publicized "sit down" strike.

The aviation chieftain has four sons and a daughter. Two of the boys are almost grown and a daughter is in high school. The remaining boys are twins, now six years old. Douglas likes to smoke a pipe, wears glasses, spends much of his time with his family in their beautiful Santa Monica estate which is in line with his position.

By the time these words appear on the newsstands, you will have heard much about Douglas' giant DC-4, the towering four-engined airliner recently completed and now undergoing exhaustive test flights. Unlike Douglas' already far-famed DC-2 s and DC-3's, the DC-4 entailed so much expense that five major American airlines agreed to chip in to foot the bill. Of course, the Douglas company itself put up a proportionate amount.

To many in the aviation the DC-4 seemed a dangerous gamble. Never before had one commercial airplane cost close to $1,500,000. In addition, the aerial monster was designed with a "tricycle" landing gear (two main landing wheels, a nose wheel and no tail skid), making the DC-4 the first large airliner ever to be so designed.

Although Donald Douglas achieved a great deal of international fame when the Army flew its Douglas biplanes around the world in 1924, the Douglas name did not become one of the most common acronautical household names until 1932—the year the first of the famous DC transports appeared. Working in conjunction with an American airline, the Douglas company designed and built the DC-1. Literally, this airplane revolutionized air transportation. Modified somewhat, the DC-1 became the DC-2 which sold like hotcakes to almost every major American airline as well as to the airlines of practically every other major nation on earth. It was only logical, then, that the DC-3 followed. The DC-3 put "sleeper planes" on a highly acceptable basis and today is the most commonly seen of American airliners.

Prior to 1932, Donald Douglas was doing a profitable business by sticking exclusively to military markets. The DC-2, however, definitely put Douglas into commercial aviation with the result that, today, the young man who scuffed along Los Angeles' pavements in search of a backer now is the head of the world's largest aircraft manufacturing plant—and the richest. The Douglas company is one of the very few American aircraft manufacturers whose credit and capitalization is rated by Dun and Bradstreet as "Aa-A1", highest there is.

So perchance, this winged tribute to Douglas' fight to achieve his mission will fall on the little barbershop where he talked with Bill Henry, or on the old planing mill where the first *Cloudster* was born. And, if there is any poetic justice, the shadow from the sky will sweep across the abodes of the haughty financiers as if a ghost from the past. A ghost that will mock the words they coldly hurled at a young man who came to them for aid—

"Donald Douglas, don't be a fool, get out of the aviation business!"

END

Parachutes

(Continued from page 22)

both killed in airline crashes—would still be alive today if the ships in which they were riding were equipped with plane-'chutes. And what about the private flyers whose facilities to combat natural forces conspiring against them are relatively meager? The number of these whose lives could have been saved by the plane 'chute is legion.

Seven years ago, W. Irving Glover, then assistant postmaster general in charge of air mail, declared:

"A sum of $1,000,000 would be a very conservative amount to offer as a prize to the man or group who successfully solve the problem of a parachute for the plane so that passengers and pilots in a troubled ship would have a chance. . . ."

But even today, in an age when little is considered impossible in the field of aviation, there are skeptics about such obvious safety devices as plane-'chutes.

As I project myself into the future, I cannot help but glance back at the past, viewing in retrospect the work of a group of almost apologetic, browbeaten individuals in the parachute development section at McCook Field, standing up valiantly to the gibes of Army fliers.

"You won't ever get me in that harness, doughboy!"

END

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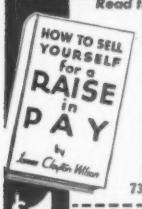

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So You Want to Be an Army Pilot?

(*Continued from page* 18)

instrument flight, spending some ten hours under the hood until he can control his plane by instrument aid alone.

Safely through the primary school, the cadet moves over on the other side of San Antonio to Kelly Field, the Advanced Flying School. At the primary school he learned how to steer the plane, how to make it do his bidding. He goes now to a school where they will teach him how to put the plane to work; how to make of it a military weapon. He will be put in the Bombardment, Pursuit, Observation or Attack sections, depending somewhat upon how his flying aptitude at the primary school has been measured. His preference, too, will have a bearing. Some students profess a desire for the highly maneuverable, little single seaters. Others like the big bombers. Some prefer the more precarious duty of the low-flying attack pilot, while the fourth group—the observation branch—finds many followers, too.

Now the student pilot takes up formation flying, he learns to drop bombs, take photographs and direct artillery fire. Day after day, time and again, he goes through these military duties of the Army flyer until he becomes proficient. He not only is a safe flyer now, but flying has become so subconscious with him that he does not have to think about flying—he can devote his whole time and attention to the military task at hand.

There will be four months of this work. Then will come graduation day. His wings are pinned on him and he is given a diploma pronouncing him a safe and capable military flyer. A great milestone in his flying career has arrived. Unfortunately, many take this graduation from the flying school much too seriously. The graduate, despite the fact that he has flown some 300 to 350 hours and has passed through a complete and thorough course, still needs much seasoning, much flying experience. There is no substitute for long hours in the air. The smart graduate cadet will remember that his graduation from the flying school does not mean that he has learned all about flying: It simply means that he has demonstrated enough skill and judgment to be trusted in a combat squadron. The most valuable part of his flying training will come later.

The flying cadet signed up for four years, one year as flying cadet and three years on active duty as a Second Lieutenant, Air Corps Reserve. He spends the first year at the flying school. He then goes to one of the tactical units of the Army Air Corps to spend the next three as a Reserve Second Lieutenant, an officer in one of our fighting squadrons, bombardment, pursuit, attack or observation, depending upon which section he graduated from at the Advanced Flying School. He goes out on the morning mission with his squadron as a wing man in a formation. He practices gunnery and bombing on the ranges. It is not unlike his work at the Advanced School, save now he is not practicing the day's work, he is doing the day's work; he is not working alone with his plane, but in harmony and close juxtaposition to nine or 18 other men in nine or 18 other planes. Before, he was an individualist at work; now he learns to work with the group. One man and one plane is but a pitiful pebble on a battlefield; it is concerted work in squadrons, groups, and wings that count. The individualist now learns teamwork. In addition, he is put to one of the many officer tasks in the squadron. He is made assistant to the engineering officer, adjutant, armament officer; he assists the mess or supply officer, or some one of the many specialists who have diversified tasks in a fighting squadron. He learns, too, how to direct the work of the soldiers assigned to his unit. Where he has been a student, he now becomes an instructor. Those are full and busy days, those two years spent by the young flying cadet graduate in his first squadron assignment.

At the end of that four-year period, the young man will have about 1,000 hours of flying instruction and experience. He now comes to a crisis in his flying career. He must elect whether he is to remain a military flyer or whether he is to transfer to civil flying. This fall, 200 of those young men who have recently graduated from our flying school and spent two years in our squadrons are to be commissioned in the regular Army Air Corps. More than 500 are taking the examinations for those 200 vacancies. I wish that we could commission them all—we need them. We have spent about $20,000 apiece on their training. Unfortunately, our budget will not permit us to take them all. Then, too, the growing demands of civil aviation require trained pilots. Our school thus far has been the best source for the airline pilot, as is attested by the fact that more than half of all the airline pilots are graduates of our school. Not long since, the airline executives came to me and asked if we could furnish them 200 co-pilots at once. So, these young men who have demonstrated the courage and fortitude to go through three hard years of military flying life will not be turned out in the cold. We keep from 500 to 800 of them on for from three to five years active duty as Reserve Officers. We hope to be able to commission some 200 annually in the regular Army Air Corps, and we believe that the civil industry will be glad to get those who desire to go to civil life. This we know—every flyer we train will for several years be a potential Army flyer if war ever comes to our land or our people, and we feel that military aviation is one of the principal defenses this nation will have if she is ever attacked.

We agree with modern military

thought the world over: That nation which cannot command supremacy of the air in any future war must certainly lose it. We have noted the tremendous efforts all the leading nations of the world are making for air armament. We have noted their frenzied, frantic desire to build up tremendous air establishments at the earliest possible moment. That is why we count our flying cadets such valuable military assets; that is why we train them so well; that is why we graduate every one of them we possibly can.

An air force is a compound of three things: flying men, flying machines and air bases. Flying men are not the least of that trinity. So, those 340 young flying cadets who enter our Army flying schools every four months are not stepchildren with us—they are important members of the military family. You may count upon it, we teach them all that we know. We guard their lives jealously for tomorrow, or the day after that, they may be riding our wings into battle. They will man the squadrons we shall lead. To them may fall the task of defending the air frontiers of this country of ours.

END

Model Goes to War

(*Continued from page 33*)

War days. The top wing, full sized, gives flight stability, while a shorter lower wing, sloped upward at around 15 degrees is designed to aid in take-offs and climbs.

The models may be catapulted into the air from miniature slings, though tests have determined the fact that they can take off from a field. The objection, however, lies in the gasoline needed for the take-off alone, lessening to a considerable degree the time of the actual flight and target practice.

A good deal of wood will be used in the models which, once brought down, will probably be patched up and used again.

Throughout the Army great secrecy has been maintained on every phase of the planes, and information can only be surmised from a few stories here and there, and the actual bids. These have gone forward to manufacturers in envelopes marked "Confidential" and each bid must be returned whether the manufacturer wishes to submit figures or not. The sheets are being treated as money would be, and each one is numbered and an constant check kept on it.

No one has received any invitations yet for bids for the radio equipment, which will weigh, in relation to the plane, about the same as would a pilot and his radio equipment on a pursuit ship, and it is surmised in many places here that the Army may undertake to do the actual manufacture of the complicated mechanism itself.

But if you should see a little man in a ground control seat, putting a model plane through its paces, high up in the air, don't be too surprised.

END

Flying Farmers

(*Continued from page 48*)

In commenting on this incident Bill sounds a note of warning. "At best this was a very poor way to learn to fly and a hazardous one but at that time when instructors and ships were few and far between, it was a necessity. Today, with plenty of good instructors and dependable ships . . . don't take the chance I did of necessity just to prove you are a 'natural'."

Since his first unexpected hop Bill has flown a half million air miles. In the past year he has flown 15,000 miles in California alone on survey and photographic trips for the Federal government and made a total of 600 flights from the home port and still he is constantly practicing to make his flying a clean-cut, precise example for his students to follow. Due to the location of the field which lies in a valley extending east from the Pacific Ocean and is sheltered from north and south winds, there is never a cross wind on the runway. This condition might cause flyers to take the easiest way and develop a routine method of landing, but Bill varies his and instructs students to come in high one time, low the next and from both sides to keep from becoming set in their way of approach. They fly right down the chalk marks he puts on the blackboard.

The present field is ample in size to provide landing space for the planes now in use but when air lanes are as thick as bus lines and really fast jobs swoop down the Santa Clara Valley, Santa Paulans want to be ready with a smooth, beckoning 3,000 foot runway that would provide a landing field for the commercial airliners that daily fly the Los Angeles to San Francisco route just a few miles to the east. It is hoped that 1,200 feet of property at the west end of the present field will be acquired to accomplish this before some outside interest, not so air-minded, purchases the land and constructs a four-story fertilizer plant or other obstacle just as hard to miss.

If all the plans for the advancement of Santa Paula's aviation are realized, the future will be a bright and happy one and with the present instruction youngsters of the community are sure to follow in the slipstreams of the airport's pioneers—it's flying farmers.

END

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Big Wind

(*Continued from page 25*)

ances are automatically transmitted, by the seven "electric eyes", to a centrally located meter board. On this panel are located, meters for each of the balances, along with a clock, thermometer, barometer and a small blackboard to identify the test. The panel also contains switches for change in range of the forces.

Provision for photographing the meter panel on photostat paper, thus instantaneously and permanently recording the complete data, is an original feature of the system. By this plan, all readings are taken at once, eliminating errors in recording data and in reaction time of the recorders. The camera will operate fast enough to take pictures every second if desired. Moving pictures may also be taken to show transient forces, which are quick stresses rapidly appearing and disappearing.

When the plane is "put through her paces" a definite procedure is followed. First, the model is carefully mounted on the three prongs. The airstream is then set into motion and, when a specified speed is reached, the plane is gradually put into a dive. It then levels out, goes into a climb and returns to normal. With the "pitch" test completed, the "yaw" is measured. The model is slowly turned to the left, then to the right, and back to normal again. While the plane goes through these movements, actuated by hydraulic cylinders, its position in degrees yaw and degrees pitch, and the forces acting on it in these positions, are indicated on the meter panel. The procedure is repeated for other air speeds. During this time a camera photographs the meter panel at regular intervals, recording the test.

Many of the features embodied in the new structure are unique in the field of wind tunnel design. At present it is the largest tunnel owned by any college or university. Models can be mounted and dismounted in shorter time than in any other tunnel of its kind. Tests can be performed more rapidly than in any tunnel heretofore. The range and sensitivity of the weighing system is so great that models can be accommodated having a lift of 2500 pounds and, on the other extreme, of only 25 pounds. The balances are the first made which can measure instantaneously, and with extreme accuracy, a force of extremely short duration.

Photographic records of all data are easily obtainable. The propellers, vanes and the general design of the tunnel are thought to be the best that modern aeronautical engineering can contribute to the art of wind tunnel design.

The wind tunnel was constructed primarily for research conducted by the advanced students and the faculty of the School of Aeronautical Engineering at the University of Washington, but the commercial tests of models and parts of airplanes by the industry will be of equal importance.

END

Test Your Ship's Performance

(*Continued from page 66*)

It is necessary to record the r.p.m. on all test flights. The record will be very helpful in selecting the best propeller for the revolutions per minute and the flying speed indicate the efficiency of the propeller. A chart on a set of propellers of various pitch-diameter ratios is shown in Section 16.

For more detailed study the tests should be corrected to standard atmospheric conditions. Two formulae shown in Section 17 point to a lot of calculations not required for routine tests.

All above-mentioned tests can be finished in a single day if the weather is right and arrangements are made before starting with the flights.

END

Radio Lights

(*Continued from page 23*)

ode ray oscillograph. He also found a way to reduce line loss in transmission of electricity, and has done other valuable service for power engineering.

Mr. Heim has been working with Mr. George for the past eight years, and the two together have made an effective research team. They have ranked among the leaders in electrical and radio research, and their latest contribution promises to give them a permanent place of importance in the field of science.

Laboratory tests, which have been conducted over an extended period, prove their radio lights to be successful and practical. Now however, their laboratory equipment is being modified for field tests, which will be started soon. There is every indication that pilots, air passengers and airlines will in the future finde ample reason to express thanks to the modest pair of research experts for their valuable work.

END

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(*Continued from page 42*)

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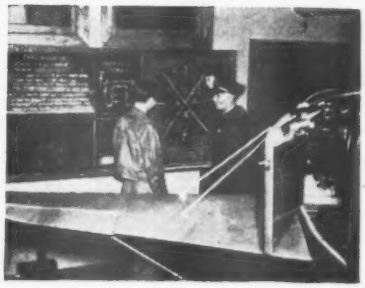

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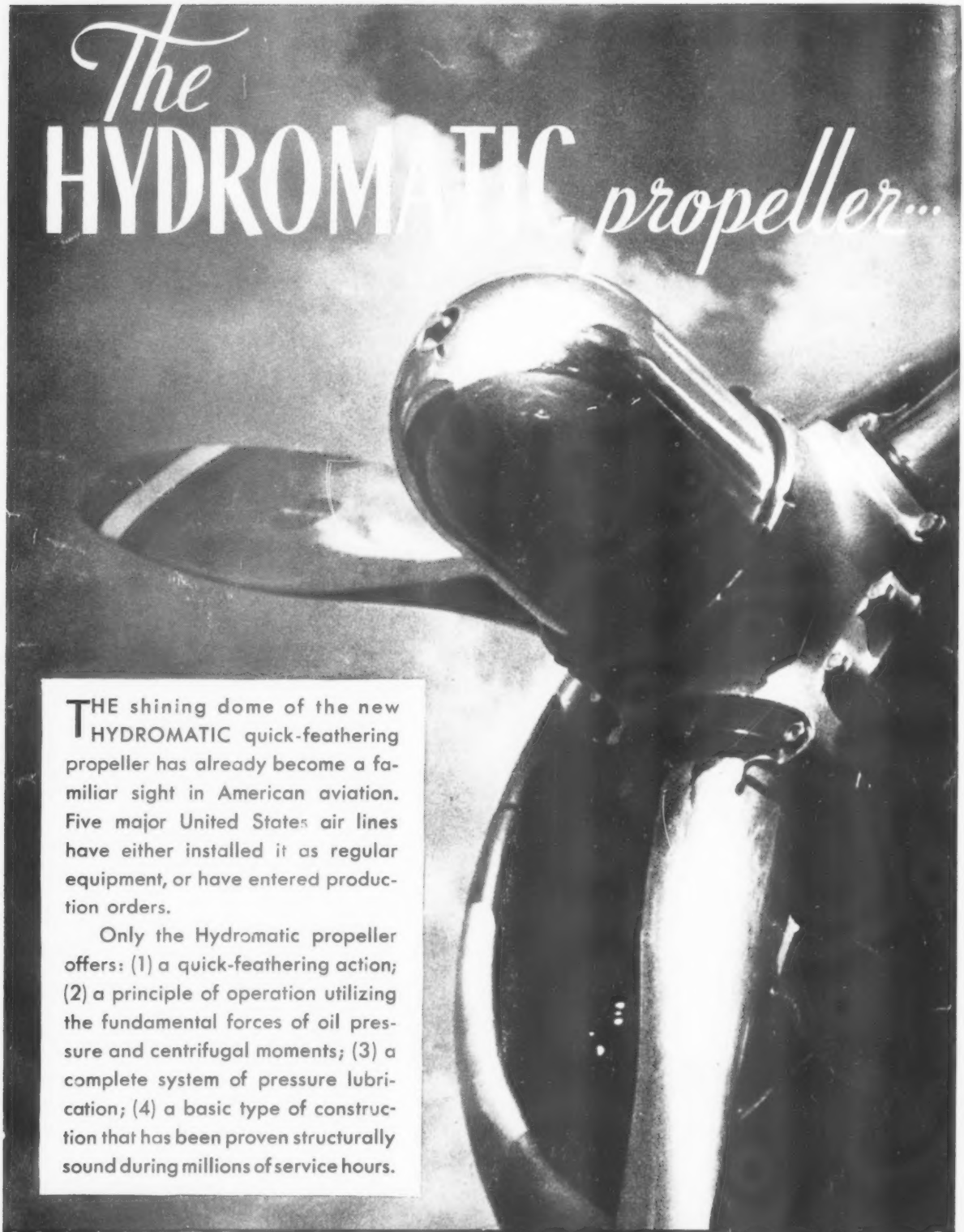

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